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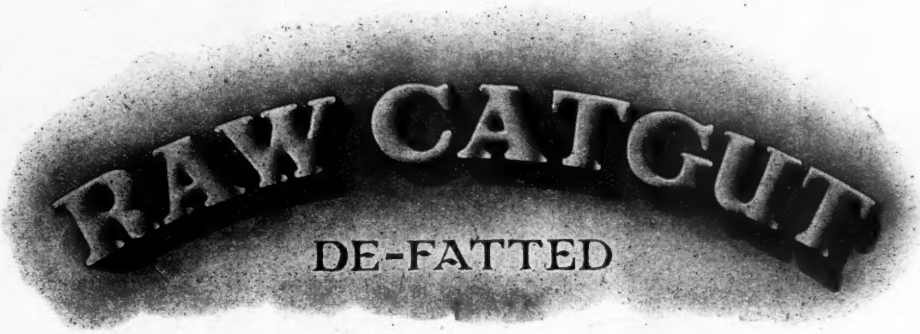

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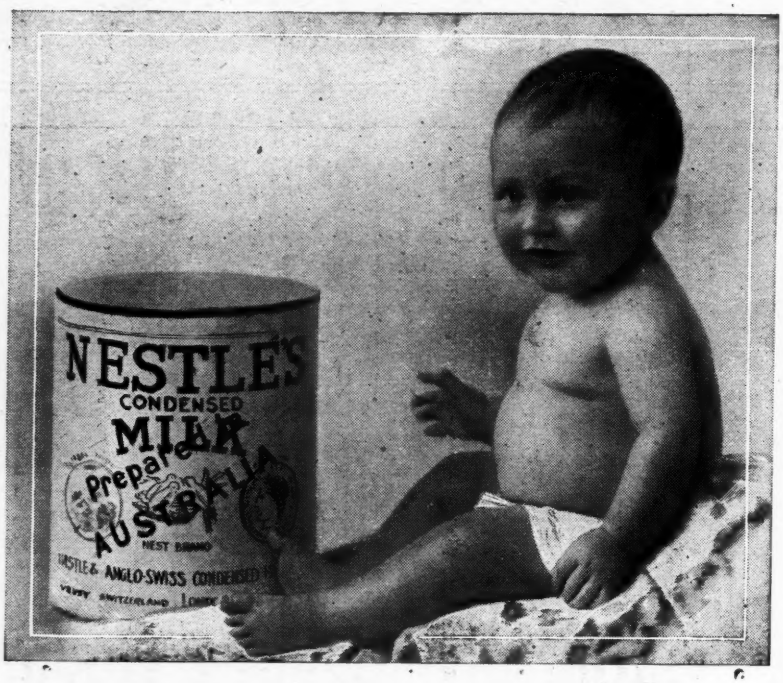

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HYDATID INFESTATION OF BONE, MULTILOCULAR HYDATID DISEASE AND ORDINARY HYDATID CYSTS.[1]

By **C. E. Corlette, M.D., Ch.M. (Syd.),**
Surgeon to the Sydney Hospital.

Hydatid disease has not lost its interest for us in Australia. It still kills people. It still furnishes problems of many kinds. And we are still finding cases, mines of interest, from which we can obtain new matter for study, from which we can reach forward to some new knowledge and by which we can test the value of current views.

The case I here record, I think, represents an instance of this; I have presumed to take it as a text for a discussion on multilocular hydatid disease, and also on its relation to the more usual type that everybody knows. Whether I have, in this attempt, presented any very new ideas, or made any valuable contribution to our knowledge, remains to be seen. I have not hesitated to take what risk there may be in declining to be influenced by current views, but I hope that the reasons given for this will prove sufficient excuse for the responsibility thereby incurred.

Let me begin, therefore, by stating the text, which is set out in the case-record subjoined:—

H.H., male, *æt.* 65, from the Coonamble district, New South Wales, was admitted to the Sydney Hospital on November 2, 1918, complaining of pain in the right thigh and hip and a swelling of the same thigh, which was said to have existed for eight years.

The notes record that eighteen years ago he had had pneumonia, but, with this exception, had apparently enjoyed ordinary health up to nine years ago.

Nine years ago a horse fell on the limb. It was said not to have been broken, but he had been lame ever since. Three years later he was run over by a cart, when the limb became very swollen. The swelling was incised. The swelling never entirely disappeared. He had had to walk with a stick for several years past. For the past five years he had been subject to attacks of stabbing pain in the thigh and buttock. Twelve months ago he noticed the appearance of a small swelling in the groin, and three months later a larger swelling appeared below the inguinal ligament.

Present Condition.—He lies with the right leg everted and is unable to rotate it inwards. The right lower limb is 15 cm. (six inches) shorter than the left. There is a large, uneven tumour, smooth in contour, most prominent above and internally, and projecting there, say, 2 or 3 cm.. It extends downwards from the inguinal ligament in the femoral region to near the junction of the middle and lower third of the thigh. It is not tender on pressure; it is elastic, but not fluctuating. In the inguinal region is a further large swelling, which is soft and elastic to touch and gives an impulse (?) on coughing. The swelling can be felt to fill up the inguinal canal and pressure reduces it in size. Over the most prominent parts of the swelling the skin has a dusky red, congested appearance. Behind, a large, tense, elastic tumour can be felt below the gluteal fold. The muscle of the thigh is considerably wasted and the upper portion of the thigh is disproportionately large, as compared with the lower part.

On palpation of the abdomen a large, elastic mass can be felt outside the lateral border of the rectus, extending up from the inguinal ligament to the right costal margin. It is not tender anywhere, except to a slight degree in the angle between the twelfth rib and the sacro-spinal muscle. The area of the mass is dull to percussion and it is continuous with the liver dulness above.

Circulatory System.—The arteries are thickened, the heart sounds distant and the second aortic sound accentuated. The only note about the respiratory system is that the patient suffers from a cough.

A radiographic examination was made and the plate showed fracture of the right femur at its upper extremity, with appearance suggesting a new growth. There was great enlargement of the bone. The shadow of the ilium was faint and ill-defined and showed irregular defects of calcification.

On November 6, under anæsthesia, a small incision was made over the upper of the two tumours in the region of the groin. Immediately a large quantity of a soft, mushy material, of granular consistency, and somewhat resembling boiled milk-sago, flowed out of the opening. A close naked-eye examination showed that it consisted of enormous numbers of minute hydatid cysts mixed with a smaller and apparently granular material. (These granules also, it may be said, were found later on to be more minute hydatid cysts, of microscopic dimensions.) The material, therefore, consisted of a pultaceous mass of closely packed hydatids. A finger was then inserted and a large cavity was discovered containing several sacculations dividing it up into loculi. Somewhere on its medial wall a small opening was found, at first not large enough to admit the finger. This opened out into another large sacculated cavity extending downwards into the femoral region and dipping deeply into the adductor side of the thigh, but subcutaneous in its anterior portion. Both these cavities contained also numerous small pieces of friable calcified deposit, one or two pieces being as large as the terminal phalanx of a finger. These pieces were obviously not bone. From beside the first cavity a small, separate sac about as large as a walnut was dissected out entire, and found to contain the same material as the cavities first opened. There was no trace of any mother-cyst.

The cavities were washed out with saline solution and the wound closed without drainage.

The wound looked well and matters went on all right for a week, but it gaped again, unhealed, when the sutures were removed. Immediately again enormous quantities of the same soft, sago-like material began to pour out. The tense, elastic tumour behind disappeared and its site became soft and lax. The edges of the wound showed some redness, the temperature rose somewhat, though not very high. On the tenth day a few blood clots began to exude from the opening, and continued to escape till the patient died, on the twelfth day. The apparent hæmorrhage was not very large. The sago-like discharge continued to the last.

Post-Mortem Examination.

The cavity opened up at the operation was found to intercommunicate with other larger and smaller loculi around the upper part of the femur, and these again with other cavities passing up behind the iliac bone and through erosion-holes and also *viâ* the obturator foramen into the pelvis and thence upwards. The swelling which had been noticed behind the hip, below the gluteal fold, belonged to a very large cavity extending up over the *dorsum ilii*. It was found at the post-mortem examination that this contained, together with the material which has been described, a large quantity of blood-clot. It seemed that the chief bleeding had occurred in this cavity, and it seemed that it might be explained by rupture of a large vein on relaxation of the hydrostatic pressure as the hydatid material drained away.

[1] Through the courtesy of the Editor of *The Lancet*, that portion of Dr. Corlette's article which deals with his own observations, is published simultaneously in our esteemed contemporary. Dr. Corlette's discussion on the general questions receives editorial comment in the same issue of *The Lancet*.

The large mass noted on the right side of the abdomen was found to have been produced by an enormous ramifying cavity reaching from within the pelvis up along the general course of the psoas as high as the liver, but not invading the liver and not invading the kidney. The cavity was medial in relation to the kidney and partially covered it.

As for the bone, the right side of the pelvis was eroded everywhere, and its skeletal structure was reduced to a fretwork, or network, of thin bone. The acetabular cup had vanished, and with it had vanished the head of the femur. Through the perforation extended a large branch connecting the upper cavity with the cavity in the femur. The neck of the femur was tunnelled by this, so that only the cortical part survived. The tunnel opened into a large gap at the top of the shaft of the femur, the trochanteric part of the bone being very widely expanded around it. The cavity here became continuous, with the loculi around the femur and the dorsal surface of the ilium. The congeries of intercommunicating cavities from above the kidney down into the upper part of the thigh, notwithstanding all the drainage that had been going on, still contained several pints, perhaps several quarts, of the characteristic, creamy-white, mushy agglomeration of tiny hydatids that had oozed out at the operation. But they were not all so small. There were cysts up to something like 2 cm. in diameter, though these larger ones were few in number.

FIGURE I.
Bone Preparation.

In addition to the system of intercommunicating cavities on the right side, other separately encapsuled accumulations of the same material were discovered at the post-mortem examination. One was a very large sac lying in the soft parts of the other (left) thigh, mainly posterior. It reached from the level of the upper end of the bone above nearly to the popliteal space below. Another was a sac between the spleen and the diaphragm, the top of the spleen forming its floor and the under surface of the diaphragm forming its roof. This accumulation was about the size of a small orange. It will be remembered that another small, separate sac was removed entire at the operation.

The kidneys and liver were entirely free from any sort of hydatid growth or deposit. So was the left lung. But the right lung presented a very remarkable appearance. The whole of the apical part presented a marbled appearance, giving the impression that a series of small hydatid cysts were lodged beneath the pleural surface. At the lower margin of the upper lobe another hydatid mass could be seen, of about the size of a pigeon's egg and elastic in consistency. This was incised and found to contain a densely packed mass of crumpled-looking hydatid membrane, cutting like a solid jelly. No free fluid exuded from the section, and there was no sign of an enveloping mother-cyst. No further cut was made in the fresh tissue, but it was put into hardening fluid for examination later on. As it turned out, this was a pity, for it spoiled the prospects of a good photograph. There were no pleural adhesions.

The hardened lung was sliced up on February 3, 1919, and an extremely interesting condition presented itself. Unquestionably and unequivocally it was no less than a multilocular hydatid of the lung. The marbled appearance which had been seen at the apex was not due to separately embedded hydatid cysts, but to digitations of an infiltrating mass of crumpled hydatid tissue. At the apex the mass was distinctly more cystic and less solid than at the lower aspect of the lobe, and there were larger cystic formations, but all irregular and crumpled. Separate cysts could not be isolated from one another, but there were a few isolated, small-sized cysts outlying from the main mass and enveloped by normal-looking lung tissue. There was very distinct mineralization of a few of these outpost cysts, none of which were larger than grains of wheat. And they were quite as hard. It could not be said that the main mass was appreciably calcified. The main mass extended through the lobe from its lower surface up into the apical portion. Serial cuts showed its continuity, though in the middle part it showed less prominently and seemed to be more mixed up in the connective tissue framework of the lung. It might be said that the whole existed as a somewhat sinuous formation of densely-packed hydatid substance, about the thick-

ness of a finger in its middle and expanding towards the apex and base of the lobe. The apical part was digitated, not, however, by connective tissue framework, in such a way that it might be roughly compared to the contour of a moderately distended kidney pelvis.

Very similar appearances to those seen in this lung have been figured by Ramsay Smith from multilocular hydatids of the lungs of sheep. (1)

The brain, unfortunately, was not examined.

The vertebral column in the lumbar region was sawn through and the part below was removed with the pelvis and femur for maceration and preparation as a museum specimen. The bony fretwork which represented the right side of the pelvis was so delicate and attenuated that, in spite of every possible care, some breakages occurred.

The prepared specimen defies adequate description. It is shown in the excellent photograph figured, and must surely be as unique as it is remarkable.

I made a microscopic examination of the sago-like material from the bone cavities, etc.. In the first place, there was a large quantity of granular débris. The tiny grains, down to dimensions smaller than were distinguishable by the naked eye, were seen to consist of small hydatid cysts with the characteristic striated cuticle. Some of the larger cysts were also examined in the same way. In no case were any scolices detected, nor were any hooklets discovered.

Microscopic examination of sections of the lung lesion showed that the whole tract was infiltrated with hydatid material. The hydatid membrane had fallen away from the adventitious investiture in most cases, leaving gaps, in some of which shrivelled masses of hydatid membrane, with its characteristic peculiarities, could be seen. The largest lacunæ of this sort were in the apical portion. In the intermediate portion the cysts were grouped in numbers of small masses and close together. Here they were mostly of very minute size, much smaller than could be separately distinguished by the naked eye. Fine fibrous trabeculæ separated the groups into loculi. Many of these trabeculæ had been cut by the section knife, and these, of course, often failed to reach across. The normal tissue of the lung lay adjacent to these infiltrating masses of tiny hydatids without any very remarkable walling off. Around the apical masses small-cell infiltration was more noticeable, but in the intermediate part there was neither excessive development of fibrous investiture nor other evidence of great reaction as shown by small-cell infiltration. There was certainly nothing to give confirmatory evidence of the violent tissue reaction which, as we shall see later, a Russian writer has described. Neither scolices nor hooklets were discovered.

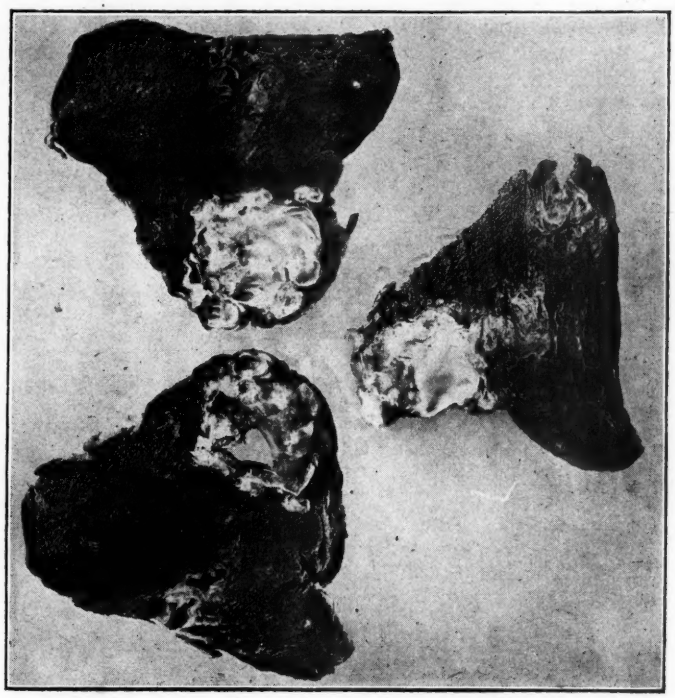

FIGURE II.

Multilocular hydatid of lung.

The figures are from photographs of a series of sections of upper lobe of right lung of H.H.. In each figure, the apex of the lung is directed towards the centre. Observe the appearance of the anterior aspect of the apex (in the holed specimen), where a crowded mass of hydatids was bunched so as to give a marbled appearance to the fresh specimen. An examination of the sections will show how the infiltrating mass of hydatid material traces an irregular sinuous course through the substance of the lung to the base of the lobe, where it expands to form a larger mass of crumpled up and tightly packed hydatid material. Most of the infiltrating mass consists of closely set cysts of minute size, set in an irregular connective tissue stroma and in close relation to normal lung. The rest of the lung shows a few spots indicating small outlying cysts, but is otherwise healthy.

Before proceeding to a further consideration of the material supplied by this remarkable case, unique as it is in some of its features, it seems to me that it will be better to review our information on the subject of multilocular hydatids.

Multilocular (also called alveolar) hydatid disease was first recognized and described in Germany by Virchow (2) in 1855. Previous to his description, the cases when met with appear to have been regarded as alveolar colloid cancer. (3) The liver was for a long time the only organ known to be affected, and the recorded cases have been very few, these coming principally from Russia, South Germany and Switzerland. The growth consists of a colony of small cysts embedded in a stroma consisting mainly of fibrous tissue, and at times there can also be distinguished the atrophic remains of liver tissue. The fibrous tissue tends to form trabeculæ through the mass. The whole is most often rounded in contour or globular, but racemose types are met with which penetrate

the liver in various irregular directions. The cysts are usually sterile, containing neither hooklets nor scolices. This, however, may be due rather to their prevailingly small size than to any other reason, very small hydatids being commonly, though not invariably, sterile. In some cases of multilocular hydatid, the racemose type in particular, the cysts appear to be coalescent, and their cavities intercommunicate. Perhaps some may not class the racemose type as belonging to the multilocular variety, but I do not see where the line can be drawn. It is usual to find a good deal of calcareous deposit in the mass, and degenerative softening, with appearances of suppuration, are found towards the centre of large formations. But although scolices and hooklets are not always found, they have been observed in a good number of cases.

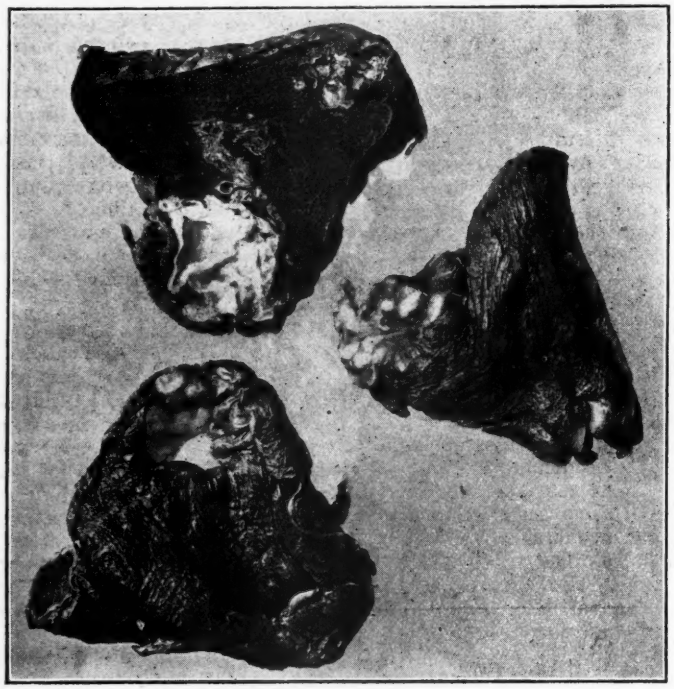

FIGURE III.
For description, see below Figure II.

Writers have been much exercised as to the way the formation arises. It is known that exogenous budding, with the production of external daughter-cysts, is a phenomenon exhibited by some hydatid cysts, just as internal daughter-cysts occur from endogenous growth. It is stated by one writer (Neumann) (4) that the two kinds of budding —exogenous and endogenous — are not generally found in the same echinococcus, nor yet in the same host. I do not know that this statement has been independently confirmed. If true, it would seem as if there existed either an influence derived from the tissus of the host, or a special propensity implanted in some races of the parasite. Whatever be the cause, it has been suggested as an explanation of the mode of growth.

Many writers have gone further and there has for many years been a strong tendency to regard the multilocular form as belonging to a different species of parasite and not derived from the *Tænia echinococcus* of dogs.

After the typical description of multilocular hydatid had been settled from examination of liver specimens, a new series of echinococcus tumours began to come under observation. These appeared to have their primary seat in bone. They have consistently exhibited many features cognate with multilocular growths in the liver, and in any attempt to elucidate the pathology, either of one kind or of the other, both will have to be considered.

In 1884 there appeared in the *Australian Medical Journal* (5) a translation of an address by Professor Virchow on bone hydatid. He showed four cases of the disease from museum specimens—two of the humerus, one of the sternum and in the fourth the particular bone was not mentioned. He referred also to a case shown at the same meeting by a Dr. Hahn. In this there was a nidus of hydatid of the characteristic kind in the lower epiphysis of the femur and another collection in the upper half of the tibia, but no communication between the two tumours. In addition, there was a hydatid cyst of the ordinary kind, 5 to 6 cm. (2 to 2½ in.) in diameter alongside the affected bone. It will be remembered that Virchow had been the first man to recognize the multilocular formation in the liver as of hydatid origin and not a colloid cancerous growth. And Virchow continued to be the leading authority on the whole subject. In the address quoted, he stated it as his conclusion that multilocular hydatid of the liver and hydatid of bone were the same disease. Moreover, he regarded the echinococcus of the multilocular form and that of the cystic type as the same parasite under different conditions of life. For an explanation of the difference, he regarded multilocular hydatid of the liver as having developed within Glisson's capsule from the vessels, while ordinary hydatids develope in the soft parenchyma and have more freedom to expand. In the case of bone, he considered that the compression there had the same effect on the size of the hydatids as did the pressure of Glisson's capsule on the individual in the liver.

Since this question of size has been raised, we may stop for a little while to discuss it.

I may say that, for my own part, I do not find Virchow's explanation sufficient. His view fails to explain why the cysts continued to be small in those collections existing in H.H. (my case), which happened to be in the soft tissues; for instance, those

in the left thigh, in the right retro-peritoneal region, or above the spleen. Compression could not there be the cause of their smallness. My own speculation is that it is partly a question of nutrition. I surmise that with such a prodigious number of individuals amassed together in the closest contiguity there would be nutritional difficulties and that the difficulty of obtaining food would interfere with growth. To my mind, it is probably a similar cause that keeps the daughter cysts within an ordinary hydatid small. And it is by no means improbable that crowding and limited nutrition is the cause of the smallness of the cysts in the multilocular disease as exhibited in the liver. When we read of the pronounced tendency to degeneration towards the centre of a multilocular formation in the liver, it becomes unnecessary to argue further whether nutritional difficulties occur.

But as regards the gross bulk of the whole colony of multilocular hydatids, it is no smaller than that of an ordinary hydatid.

I do not think, however, that the smallness of the individual cysts in a case such as mine would be wholly due to nutritional difficulties. It would be the prevailing cause in a colony wholly enclosed in the quiet precincts of an unfractured bone. But when loculi exist in soft parts subject to movement and to varying stresses, or when a bone cavity has been complicated by fracture of its containing walls, other influences come in. It will be remembered that in this type of hydatid all the cysts are naked and quite free, like marbles in a bag or daughter cysts in an ordinary-type hydatid. In my case the largest cysts were no bigger than, say, 1.5 cm. or 2 cm. in diameter, and they were few. The larger the cyst, the more frail and delicate it looked. They were like little hyaline bladders, rupturing with the slightest violence. Under the mechanical conditions present and the churning up that the mass must get as the patient moves, it is difficult to imagine how a cyst could survive to reach any considerable size, and it is not easy to explain how those of larger size managed to grow even as large as they did without bursting.

Dr. J. B. Cleland, Principal Microbiologist and head of the Bureau of Microbiology in the Health Department of New South Wales, has compiled a bibliography and short abstract of the cases of hydatid disease of bone that have been recorded in Australian periodical literature, and he has therein done a great service towards the study of the disease. (6) His compilation will be found in the Sixth (1915) Report of the Microbiological Laboratory. I have not had an opportunity of working at the literature of bone hydatids in other countries, but I have looked up the original records of all the cases noted in Dr. Cleland's list, excepting one or two of the earlier ones, which were inaccessible. In several instances from Dr. Cleland's list references have been confused by multiple allusion to one case, but I have attempted to eliminate the error thus introduced. Ultimately I find that, after adding my own, about eighteen separate cases have been recorded. In order of frequency, the femur comes first with five cases. The sacrum or coccyx comes next with three, the tibia with two, the ilium with two, a vertebra with one, the skull with one, the superior maxilla with one, the humerus with one, a rib with one and the terminal phalanx of a finger with one. In my own case it is doubtful whether the pelvis or the femur was the first affected. The pelvis was the worst, and I have therefore included it as disease of the ilium. While in all the cases the general appearance was that of a packed mass of minute cysts with erosion of bone, the size of the mass varied from that situated in the terminal phalanx of a finger to the gigantic dimensions found in my case.

Details are very scanty in some of the cases recorded, but while in some no information is given as to the existence of a mother cyst, it is expressly stated in the more carefully described cases that none existed, with one exception. The one exception is a case recorded by R. A. Stirling, (7) of Melbourne, in which a large mother cyst is said to have lined a cavity in the femur. But of the same case it is recorded that the whole of the left thigh was filled with a dense mass of hydatid material, the muscles being described as "obviously infiltrated."

Perhaps in the case recorded by B. Poulton, of Adelaide, (8) there is another exception. There was a cavity in the head of the tibia the size of a walnut filled with a tapioca-like mass. The bone was infiltrated around it with small growths of the same material. In the tibia, below the cavity, there were three separate small cysts the size of peas, the lowest being 10 cm. (four inches) from the upper end of the bone. I think many would be inclined to regard these separate cysts also as "cavities lined with cyst membrane."

There is another case to which I shall have to draw special attention. It was described by Professor Watson, of Adelaide. (9) It showed a monocyst, the size of a walnut, in a muscle, apparently the *gluteus maximus*, and in the adjacent coccyx and part of the sacrum were a number of small white vesicles the size of pin's heads.

The records show that when the bones of the limbs have been attacked there has been a marked propensity to fracture. One femur had fractured from slight violence five times.

In the vertebral case there was a history of paraplegia for 40 years!

It may be said also that, according to the records, the nidus has practically always been in cancellous bone.

I have come across an account of one very remarkable case of hydatid of the liver which seems to have possessed many of the features observable in bone hydatid or of the colonies noted in soft tissues concurrently, as in the collections found in the left thigh or above the spleen in my case. It is recorded by Stirling and Verco (10) in Allbutt and Rolleston's "System of Medicine." According to their description, it was "an enormous hydatid of the liver of a male subject, the contents of which measured 20 pints. On a calculation based on an enumeration of the daughter cysts in a measured quantity, the total of these exceeded 28,000, and this figure did not include thousands that were too small to be counted with the naked eye. Suppuration had not long commenced, but barely a shred of mother cyst could be detected. The man recovered after incision and evacuation, and about three years afterwards was again successfully operated on in a similar manner for another

large hepatic suppurating cyst containing five pints, which presented no unusual features. No doubt the second cyst existed at the time of the first operation." Though it is presumed that there had been a mother cyst, there seems to have been no good reason for thinking so. On the contrary, there is good reason to question it. Every surgeon who has had experience of suppurating hydatids, will have noticed how resistant the cyst membrane is to disintegration. It is not a proteid substance, and it resists the tryptic or other ferments of bacteria as it does those of the host. And in this case it is recorded that suppuration had not long commenced.

The question arises, how does the hydatid embryo gain its entry to the bone? It colonizes a part far away from the confines of the portal system, which is the port of entry for a primary infection. What is the channel that it adopts, and how and why does it find its resting-place in bone? Why in cancellous bone? Why so often in the femur? I do not see that any quite satisfactory answer to these questions can yet be found. But there is in a passage in the late Davies Thomas's book on hydatid disease (11) that is so apposite that I will quote it in full:—

> Probably—at least among the parasites infesting the higher animals—by far the most common course is for the embryo to enter the blood current and to be carried by it along the portal vein into the liver, where a large proportion of the embryos of some tapeworms (such as *Tænia echinococcus* and *Tænia serrata*) remain permanently in the form of hydatids, and of *Cysticercus pisiformis* in the rabbit. Others among the brood pass through the capillaries of the liver and by the vena cava inferior to the right side of the heart, thence by the pulmonary artery to the lungs, where, in the case of *Tænia echinococcus*, many remain. Others, yet, pass through the pulmonary circulation to the general systemic circulation, by which they are carried to all the various organs and tissues fed by it. In this way the embryos of *Tænia cœnurus* reach their homes in the brain of the sheep, those of *Tænia solium* the eye and cellular tissue, those of *Echinococcus* the brain, spleen, kidneys and even the bones themselves.

The above passage gives a method of direct primary implantation. We are, however, acquainted with another method of hydatidization (if I may coin such a word) in the infection of the peritoneal cavity by rupture of a fertile cyst into it. And I shall later on give reasons for presuming the possibility of embolic infection of the lung from a bone hydatid. If, therefore, we are permitted to think of embolism as a possible method of distributing a brood of secondary embryos, one may conceive of several possibilities. For instance, I have, on one occasion, removed a small hydatid cyst that was lying in the subcutaneous tissue of the abdominal wall near the umbilicus. This was perhaps an indication of another way out of the portal system for a primary embryo, not mentioned by Davies Thomas. But, however that may be, it is conceivable that the rupture of such a cyst, if fertile, could cause liberation of scolices, some of which might enter the general circulation through the venous channels, as we shall see is quite probable in bone cases, though it is true that most of them would probably enter lymphatics and be arrested in the lymphatic glands. Remember here that fat embolism may follow a lesion of the subcutaneous tissues.

In regard to the question why cancellous tissue is attacked by preference, one must bear in mind that of the total osseous tissue in the body, cancellous tissue occupies by far the greater volume, so the chances are all in favour of cancellous tissue, apart from any other consideration. The argument from volume has a bearing on the numerical frequency of the attack rate in the femur. The femur is a very large bone, and by its very size would have to carry a greater rate of risk. But the volumetric method of reasoning does not account for the sacrum seeming to be affected more often than the ilium, though here one must bear in mind that we are dealing with extremely small total numbers and therefore the fallacies due to chance are very serious. As a matter of fact, this fallacy cannot be eliminated, even when considering the femur.

Again, how does the disease spread in bone, and how, for example, was the bone in my case converted into a mere delicate fretwork? If we cannot say why, I think we can form an idea as to how it proceeds. The sacrum and coccyx in Professor Watson's case were reported to show a number of small white vesicles the size of pins' heads. In Dr. Poulton's case, the growth seemed to be spreading peripherally, and there were some separate outpost cysts in the tibia adjacent to the main mass. It seems reasonable to conclude that, by some means, living pioneer elements have found lodgement in the bone and that they grow there, causing decalcification and erosion, until a larger cavity is produced by coalescence.

Then how does the disease spread from bone to soft tissue and how do loculi form? The answer to this will probably be similar to the answer to the last question. It seems likely that pioneer elements by some means infiltrate the adjoining tissues, where they grow and produce degenerative changes ending in progressive fusion. Thence it could by the same means continuously invade soft tissues. Loculi could form by coalescence of adjoining collections. For instance, it will be remembered that at the operation on H.H. I dissected out a separate cystic collection from the side of another which was not in communication with it, but only separated by a thin wall of fibrous tissue. It would be a short and easy step for a communication to form and thenceforward the smaller cyst would be a loculus of the larger.

As regards the bone hydatid in my case, although no proliferative elements were reported as seen, I cannot imagine that there were none present, either then or at some other time. The number of individuals was altogether too prodigious to make reasonable any proposition that each one then and there present was the direct result of an embolic implantation from a distant source. Manifestly, the first pioneer infection must have come from somewhere. Was the formation discovered in the lung the original source from which the bone was colonized? Hardly, I think, though I am unable to discard the bare possibility. But the history shows a bone trouble extending back a number of years, and it is not very probable that a smouldering deposit in the lung would have remained altogether latent during the whole of that time. I should have expected some definite history of outbreaks of symptoms pointing to pulmonary disturbances, such as broncho-pneumonia. And it is remarkable that there were no pleural adhesions. My own very strong impression is that the lung de-

posit is later in time, an embolic process secondary to the bone disease. It is, in fact, altogether the standpoint from which I picture the case, though no very great issues hang to it. At any rate, we can admit, for the present, that the lung invasion is a secondary phenomenon.

But how does the colony, once formed, grow in numbers? We have seen that some have conjectured that in multilocular hydatid disease, fresh individuals arise by external budding of scolices from fertile cysts. As yet this process does not seem to have been actually demonstrated for bone hydatids by any observer, but I suppose there is no reason why it could not occur when fertile cysts are produced.

Nevertheless, I have an additional conjecture to offer. I have already drawn attention to the risk that every cyst would be subjected to as it grew larger. It would become more and more liable to burst under the stresses arising from the churning action of the body movements and, I may perhaps add, for purely bone colonies, from concussions transmitted through the bone. If one of these cysts happened to be a fertile individual, and it met with an accident causing it to burst, it would liberate brood capsules and free scolices into the general mass and there they would take their chance.

It seems to me that this is an extremely probable method of distributing new elements to the mass.

It is impossible not to remark the peculiarly striking resemblance between the broad features of my case and one of a sarcoma of bone. It is quite analogous to a malignant growth of sarcomatous type. The multilocular or alveolar type of liver hydatid has been called "malignant hydatid" from its infiltrating propensity, but bone hydatid outrivals it in permeating power and adds to it a propensity for metastatizing in distant organs. We find an invasion of bone by the parasite, producing local atrophy, softening, erosion and cavitation, followed by fracture. The clinical diagnosis would have to be made against sarcoma and against *osteitis fibrosa cystica*, and a radiographic examination would very probably be inconclusive. Then we find that the growth has not only invaded the bone, but has spread widely from its original (or seemingly original) focal point, has permeated the soft tissues in various directions and has even invaded another bone adjacent to it. But more, there has been a dissemination throughout the body. How the collections in the left thigh and beneath the diaphragm came to be formed is not quite so clear as is the apparent origin of that found in the lung, but in the lung I am sure we can say that there is an embolic multiple metastasis and that it arrived in the lung entirely through the blood stream. For, to my mind, it is much more difficult to explain such an effect as an instance, primarily, of lymph absorption than it is to explain it by direct venous carriage. At least we know that the lymph glands did not exhibit overt signs of invasion, though I am aware that instances of lymphatic gland infection have been recorded. But we can find evidence from analogy which goes to show that the blood-vascular system might be confidently expected to act as a carrier under certain contingencies. I do not propose to go to sarcoma for an analogy, but I find it in the conditions of fat-embolism. Let me direct attention to a paper produced in 1917 by George T. Caldwell and Harry L. Huber (12) on the subject of fat-embolism. Space forbids extensive quotation of their paper, but a short abstract will serve to outline the parts which principally concern us here. They quote Fritsche (*Deutsche Ztschr. f. Chir.*, 1910, C. VII., 456) for experiments on animals, as follows:—

> Veins ligated, bones of extremities struck and jarred. Fat droplets found in thoracic duct and in lungs. On the other hand, when the bones were actually fractured or the bone marrow violently disturbed by plunging wires into it and stirring it about, thereby producing hæmorrhages into it, the results obtained were quite different. In these animals the ligature of veins prevented the collection of fat in the living capillaries. With injuries of this kind, the fat embolism apparently arises chiefly by way of the veins. Fritsche suggests that the lymphatics may be easily closed as a result of the hæmorrhage.

Wilms (*Semaine Méd.*, 1910, XXX., 138) is quoted as having found a similar result. Caldwell and Huber performed a number of crushing experiments which went to show that if the animals moved freely after the trauma, considerable amounts of fat were found in the lungs, while if they were kept quiet by chloral, the quantity was very small. In other words, the trauma after the crushing caused the fat-embolism rather than the actual injury primarily inflicted. They concluded that it was due to the interference with the process of clotting of blood, or rather, the disturbance of the clots by the post-operative activities of the animals. They quote Buerger (*Vierteljahrsch. f. gericht. Med.*, 1910, XXXIX., 159) as suggesting that when quietude is obtained, there is earlier and firmer clotting of the stagnant blood, a part of the free fat being retained in the clot and the torn vessels occluded by thrombosis.

The application of these experimental data to a fractured hydatid-infested bone is, I think, direct and obvious. If medullary fat can enter the circulation when vessels are torn and rest is interfered with so as to keep them unsealed, so also, we infer, could the microscopically minute embryonic components of the parasitic mass and possibly even tiny cysts, gain entrance to the venous current and be carried to the lung in a swarm of greater or smaller number. But a very close seeding of a portion of lung with embolized embryonic hydatids or with tiny cysts would presumably be enough to create an infiltrating agglomeration of crowded cysts, quite answering to the description of a multilocular hydatid.

The hypothesis that I have just suggested, could probably be tested by a series of experiments on animals of appropriate species. They should be subjected to intravenous injections of scolex embryos, or minute cysts.

In connexion with multilocular hydatid disease there have been several writers who consider that it is probable on deductive grounds—meaning that it is difficult to explain the facts on any other hypothesis—that the condition is the result of the action of some other parasite specifically distinct from *Tænia echinococcus*, the parasite responsible for ordinary hydatid cysts. Attempts to confirm this theory by direct means have been inconclusive, but one author, Melni-

kow-Raswedenkow, has produced a paper which very greatly impressed Professor Sir E. C. Stirling and Sir Joseph Verco, the joint contributors of the part dealing with hydatid disease in Allbutt and Rolleston's "System of Medicine." (13) Both of these writers are well known in Australia, and whatever they may say about hydatid disease deserves respect. Melnikow-Raswedenkow's original paper is not accessible to me, so I cannot speak from direct perusal, but Stirling and Verco give a very extensive résumé of the original, and I give below an epitome of the salient points of his paper as there presented. I may say beforehand that I have not been impressed so greatly as Stirling and Verco. I believe, however, that I approach the subject unbiassed, and I am quite willing to be converted to his, or any other view, but I must find a more convincing kind of evidence. To my mind, Melnikow-Raswedenkow's views make more difficulties than they remove. They are summarized as follows. He regards multilocular (alveolar) hydatid disease as caused by a distinct species of organism, different from that of ordinary hydatids. He says there is a fundamental structural difference between the bladders of the hydatidose echinococcus and the chitinous* vesicles of the alveolar form, inasmuch as in the former the embryonic parenchymatous layer from which scolices are developed, is limited to the inside of the cyst, while in the latter this reproductive material is disposed not only within, but on the outside as well. He speaks of there being a violent reaction of the tissues induced by the presence of the parasite of alveolar hydatids, as contrasted with the symbiotic attitude of the hydatidose parasite. This he believes to be in consequence of the presence of the active reproductive substance on the outside. Moreover, this living embryonic substance is capable of producing, not only scolices, but also living amœboid embryos. It is by means of these embryos, which are endowed with the power of amœboid movement, that extension of the growth by continuity takes place, or if the embryos should gain entrance into a blood vessel, metastases in distant viscera may be produced. In any case, the secondary tumours may, by the resumption of the parental activities, start new centres of violent toxic reaction in the containing tissues. An embryo having wandered into a portal radicle, comes eventually to rest, but instead of becoming a voluminous, spherical, fluid-containing bladder, as in the hydatidose form, it developes into a distorted and much folded chitinous vesicle, which contains, both between its folds and between these and the walls of the containing cavity, the finely granular protoplasm which serves the purpose of reproduction and is the source of its poisonous activities. The toxins of the parasite in its intravascular nidus set up endophlebitis and subsequent necrosis of the intima, and, by means of outgrowing offsets or processes from the chitinous structure which perforate the vessel-wall and penetrate the tissue-elements, the parasite forms for itself an alveolus in Glisson's capsule, or similar cavities may be formed in the tissue spaces independently of the blood vessels. The contorted chitinous vesicle is the homologue, not of an ordinary echinococcus bladder, but of a ripe segment of a *Tænia*, because, like the latter, it can produce living embryos. These, again, are capable of repeating the activities of its parent, either in adjacent tissues or in distant organs. Hence its malignant characters and, at the same time, the explanation of its multilocular character. The active factor in the reproductive process is the finely granular protoplasm inside and outside the folds of the chitinous formation, and it may manifest its activities under three forms: (1) scolices, as in ordinary hydatids, (2) immature embryos, more or less spherical, and without a capsule and (3) mature ovoid embryos with a chitinous capsule. The scolices, being enveloped in embryonic tissue, which, contrary to what happens in hydatidose echinococcus, is directly in contact with the tissues of the host, are consequently exposed to the phagocytic action of the tissue cells and so become destroyed. It is for this reason that scolices are difficult to find in the tumour formation of alveolar hydatids. The immature embryos wander into the lymphatics and capillaries and there develope into sterile and abortive vesicles, which eventually disappear in the necrotic changes wrought by their own toxins in the tissue elements of the part. A like fate may befall some of the ovoid embryos. Others of these may become encapsuled by firm connective tissue and undergo calcareous infiltration. More often they fall victim to the necrotic processes they initiate. Other ovoid embryos, again, may make their way into blood or lymph vessels by amœboid movements and be carried like emboli to distant organs, where they form metastases.

Finally, Melnikow-Raswedenkow considers that the parasite of *Echinococcus alveolaris* occupies an intermediate position between the *Cestodes* (tape-worms) and the *Trematodes* (flukes), from its power of producing amœboid embryos *in loco*.

So far as I know, Melnikow-Raswedenkow's work, though published now a good many years ago (1901), has not yet been independently confirmed.

I feel sure that Stirling and Verco have given a careful and accurate rendering of Melnikow-Raswedenkow's views. But, notwithstanding the favour with which these views have been received, I feel bound to say that they produce a feeling of distrust and scepticism in me. I may be wrong. But when we read of the method of proliferation I am left dissatisfied. We are told of scolex formation, of immature embryos and of "mature ovoid embryos with a chitinous capsule," all proceeding alike from a granular protoplasmic layer lying on either surface of a chitinous structure embedded in the alveoli. And this is referred to particularly as homologous, not with the cystic form of echinococcus, but with a ripe segment of a *Tænia*. I possess no claim to be considered a helminthologist, but I think, nevertheless, that before such a homology should be asserted, there should have been some demonstration of the sexual organs of the supposedly homologous individual or organism. Instead of this, we find no more than granular protoplasm, simple zooid material. If anything one could call embryos were thrown off, the

* According to Hammarsten, the chief organic constituent of the walls of hydatid cysts is a substance which he describes under the name of "hyalin." He states that from a chemical point of view it stands close to chitin, or between it and the proteins. (*Text-b. of Physiol. Chemistry*, tr. by Mandel, 2nd English ed., from 3rd German ed., p. 575.)

homology, to my mind, would be nearer to that of a larval organism, whose method of generating embryos is asexual. This, as is well-known, is the method by which the scolex embryos of an ordinary hydatid are produced. And again I may be wrong, but I am surprised at reading of the power of amœboid movement described as characterizing the "mature ovoid embryos with a chitinous capsule!" To put it shortly, the biological work seems to be so imaginative as to leave me wondering whether the rest of the work is of the same type. It gives me a suspicion that Melnikow-Raswedenkow may have seen some of his facts through the distorting medium of a ready-forged hypothesis.

At first appearance, these views or hypotheses seem to provide a beautiful explanation of the phenomena of multilocular hydatids. Then one begins to ask questions. And when one pushes enquiry, one comes forthwith upon difficulties. Thereupon a dilemma arises. The hypothesis, or hypotheses, for there are several, must either solve the difficulties or split to pieces.

Let us, first of all, decide what is the relationship of bone hydatid to ordinary hydatid disease on the one hand and to multilocular hydatid on the other. If these two pathological conditions are the result of the action of two specifically distinct parasites, then bone hydatid must belong either to one or to the other, unless bone hydatid belongs to a third species. Let us see, then, what connects bone hydatids with the ordinary form. In the first place, the cavities of a bone hydatid are filled with individuals which are at once recognizable as free cysts, mostly very small, but, as in my case, a few may be as large as cherries. It is not possible to deny that these are hydatid cysts, though not enveloped individually in a fibrous stroma any more than are daughter cysts within an ordinary hydatid. Again, R. A. Stirling's case is recorded to have contained a large mother cyst within the bone cavity. In B. Poulton's case there were three small separate cysts in the bone adjacent to the main mass. In the case described by Professor Watson, also already cited, a monocyst existed in a muscle adjacent to the affected bone, and in Hahn's case, referred to by Virchow, we have seen that an ordinary hydatid cyst, 5 to 6 cm. in diameter, was situated alongside the affected bone. Finally, Stirling and Verco (14) have also come to a similar conclusion, for they remark, in connexion with a case of hydatid infestation of the vertebræ, that the minute cysts therein contained are the ordinary *Echinococcus hydatidosus*, for when they get into the spinal canal, the chest or the abdomen they become of the ordinary size. These cases seem to link bone hydatid securely to the common cystic form of hydatid. I may perhaps appropriately interpose here to remark what a god-send would be the revelation of an embryo capable of progression by amœboid movements, or otherwise motile, to a puzzled investigator trying to find a reasonably probable explanation for the appearance in Hahn's case of two disconnected deposits of bone hydatids, one in the lower end of the femur and the other in the upper part of the tibia of the same side! But mere hypothesis does not serve; we must have actually observed and well verified facts.

Returning now to our enquiry, we may endeavour to see what is the relationship of bone hydatid to multilocular hydatid disease of other organs. My case, I think, provides a most important clue to the truth.

The condition found in the lung of my patient, after taking into consideration the difference in the structure of the organs attacked, allows no reasonable doubt of its identification as a multilocular (or alveolar) hydatid formation strictly comparable to the descriptions of the same disease affecting the liver.

But in the same person existed an equally typical example of bone hydatid.

Each of these conditions is an extremely rare phenomenon. The mathematical probability of a coincidence of these in one body as invasions of two specifically distinct parasites is so inconceivably infinitesimal as to be practically equal, though not theoretically equal, to impossibility. If this be admitted, the identity of the parasite causing each lesion is practically demonstrated.

The inference may be reasonably drawn that multilocular hydatid disease of the liver is also produced by the same kind of parasite.

Or rather, that is the way the argument appeals to me. But not so, it seems, to all. Not to Melnikow-Raswedenkow, for instance. The mathematical argument does not seem to have caused him any inconvenience. We find Stirling and Verco remarking as follows: "In confuting Virchow's dictum, that the two forms are determined by differences of the tissue conditions of the affected part, Melnikow-Raswedenkow insists that both the cystic and the alveolar forms may be found not only in the same animal, but in the same viscus."

This may, indeed, confute Virchow, but it is rather astonishing that the confutation was not perceived to be a boomerang-like weapon that recoiled to confute also the author's own thesis. I have used the fact that the cystic form of hydatid has been found in several cases very closely associated in the same limb with bone hydatid as a strong presumptive argument in favour of their specific relationship, and I submit that that is the reasonable way of looking at the facts. But if we assume, for the purpose of argument, that the cystic hydatid and the multilocular hydatid are produced always by two specifically distinct parasites, we can go on to enquire what may be the chances of a coincident infestation of an organ, say the liver, by the two parasites. It is acknowledged that one of the species said to be distinct is very rare and the other, though relatively much more common, is far from general in its incidence. I do not know the frequency figures of either form in any community where both occur. Nobody knows. But for the sake of a mathematical illustration, let us imagine a hypothetical case. Let us suppose that in a given community there are, to each million inhabitants, 10 cases of multilocular hydatid of the liver and 1,000 cases of cystic hydatid of the same organ. Calculation shows the probability that one person in each hundred million inhabitants will be a host of both parasites together and that we shall experience one case of superadded multilocular infestation in each hundred thousand cases of cystic hydatid.

We have already noticed some of the biological difficulties or deficiencies of Melnikow-Raswedenkow's statements. If we add to them the mathematical improbabilities that he has incurred, I think I am now able to say that I have sufficiently justified my remark that his views make more difficulties than they remove.

But these difficulties, deficiencies or improbabilities do not seem to have been sufficiently regarded by Stirling and Verco. For, in the paragraph immediately succeeding that which contains the sentence I have just quoted and criticized, they proceed to announce their adoption of Melnikow-Raswedenkow's main thesis. They record here that they find it impossible to resist the conclusion that in *Echinococcus multilocularis* or *alveolaris* they have to deal with a parasite specifically distinct from that of the common hydatid. (15)

This is a real conversion, for their former view, stated in the original edition of their article, and written before the appearance of Melnikow-Raswedenkow's paper, was in accordance with that of Virchow. (16)

The conversion of Stirling and Verco was important. Their opinion carried great weight in all English-speaking countries, and their authority has been accepted where, without it, Melnikow-Raswedenkow's statements and views might have been more scepticially regarded and more critically analysed. At all events, Stirling and Verco's verdict on this question is referred to with much respect by other writers (Castellani and Chalmers (17) for instance), and whether that opinion has been a strongly prevailing influence or not, it is certainly a fact that the two-species doctrine is now very generally accepted and taught.

The recorded cases of multilocular hydatid disease in man have been confined to certain parts of Europe and have not emanated from some other parts where ordinary cystic hydatids are said to be frequent. It is urged by various writers that this is to be accounted for by assuming that it denotes the geographical distribution of a specifically distinct parasite limited to those regions whence multilocular hydatid cases have been described. Then some point out that, though the ordinary cystic form of hydatid is common in Australia, cases of multilocular hydatid infestation (evidently here they must mean human cases) have not been recorded there. It is argued that some cases of multilocular hydatid ought to have been recorded from Australia if the ordinary parasite could cause the disease, but the absence of such cases is held to confirm the probability that a special parasite is required and that this parasite has not yet found domicile in Australia. All this is pure deduction, but it has produced a decided bias towards the theory of two species. C. W. Stiles, (18) for instance, states that he is influenced in his opinion that there are two species or sub-species largely by geographical distribution and by the larva. By the larva I take him to mean the multilocular formation itself. However, these writers do not seem to take into consideration the whole of the facts, and a sound deduction must take every fact into satisfactory account. The real problem that has to be solved turns out to be something very different indeed. We find that Ramsay Smith, (19) of South Australia, who himself leaned to the suggestion that there must be two species of parasite, published a paper in 1905 in *Medicine*, an American journal, wherein he described and figured a number of cases of multilocular hydatid from the bodies of various animals, and he asserts that this form of hydatid is very frequent, up to 70% or 80% in some lots of sheep. He says that he had examined over 1,000 specimens showing the multilocular formation.* He also makes the very significant remark that in pigs and oxen it was not uncommon to find multilocular tumours in the liver and acephalocysts (*i.e.*, sterile simple cysts) in the lungs, an occurrence that lends itself to the argument already considered. It appears then that, if there are two species of parasite required for the two forms of hydatid disease, the multilocular species must be abundantly domiciled in South Australia, even though in human beings only the cystic form has seemed to find a place.

So the problem really is to find a reason why the supposedly distinct multilocular species, so very common in South Australian sheep and other animals, is not correspondingly represented in man. But it is easy to see that if it were not a different species, but merely the same species as that producing ordinary cystic hydatids, the difficulty would vanish entirely. Does it not seem as if the tables were turned on the argument from geographical distribution and that we find here one more instance of a theory making more difficulties than it removes?

The directing of our attention to the geographical distribution of cases tempts me to make a diversion that does not logically enter into our present subject, but I have for years been so greatly interested and puzzled by the questions involved that I cannot forego the opportunity here afforded. We find it stated that hydatid disease is very common amongst cattle in India. I quote, for example, the statement of Friedberger and Fröhner (*Veterinary Pathology*, Tr. by M. H. Hayes, 6th Ed., Vol. 1, p. 292), and repeated also by other writers, that in British India echinococci are found in the livers of 70% of all cattle. This would not be a very remarkable fact, taken by itself. But when we also learn that hydatid disease is a rare occurrence in human beings in India, then we do find the situation very remarkable. The question arises, why is this so, when in other countries a smaller incidence of the disease in sheep and cattle is associated with a comparatively large incidence in human beings? Whatever the cause, is it the same cause that makes hydatid disease of man relatively uncommon in the more tropical parts of Australia?

Now it is time to say that one finds, or at least I do, a considerable amount of difficulty in reaching a consistent logical general definition of the term "multilocular hydatid" unless one is allowed to include also the form of invasion with which we are so familiar, and which we recognize under the term "multiple hydatid disease of the peritoneum." At its first introduction, the term "multilocular hydatid" was coined to connote a special kind of hydatid

* Ramsay Smith says in his paper that he had sent a series of his specimens to the pathological museum of the Edinburgh University, and another series to the museum of the Royal College of Surgeons, Edinburgh.

infestation or infiltration of a single organ, the liver. But since the introduction of that term, analogy, confirmed by the authority of Virchow, has sanctioned the inclusion within the same connotation of a certain form of hydatid growth associated with bone. Further observation and experience makes it expedient to comprise within the meaning of the same term a form which we have just described in the lung. Thus far we have proceeded along an apparently logical and consistent path of terminology. But to my mind we now come in sight of a difficulty. How does analogy shut out multiple hydatid infestation of the peritoneal cavity when it can be allowed to admit and include the multiple forms of hydatid colonization known as multilocular hydatid of the liver, of bone, of muscle and fascia proceeding from bone and of the lung? The differences between the forms just mentioned are just the natural differences due to the environment, the *locus in quo*. Are the differences between multiple peritoneal hydatidization and those other forms fundamental, or is the analogy the same and the differences no more than might be expected from the peculiarities of the *locus in quo*, just as they are in the other cases? Is it then mere arbitrariness, or is it logical and consistent and right to regard the peritoneal disease as not belonging to the type?

Every Australian surgeon of any experience has seen numbers of cases of multiple peritoneal hydatidization, ranging from a colonization apparently scanty to one of many hundreds, perhaps thousands, of individual cysts. The constituent cysts lie in a matrix of supporting connective tissue derived from the peritoneum and omentum and constituting the adventitious investment. This frequently forms a nest for hundreds of closely packed individuals of all sizes, from that of a pin's head upwards to that of an orange. In these closely packed masses one finds that frequently a number of the cysts are in direct cuticular contact with one another within the trabeculæ of the connective tissue investiture in which they lie. The larger cysts frequently contain accumulations of daughter cysts, in regard to which it may be remarked that, if it be a fact that external proliferation does not occur in the same cyst nor in the same person as internal proliferation, then that form of proliferation is barred when any of the cysts exhibit their propensity to internal production by containing daughter cysts. However, that point can hardly be regarded as settled.

No surgeon familiar with the appearances and peculiar characteristics of multiple peritoneal hydatids ever doubts that all these cases are due to the rupture of a fertile cyst, or cysts, into the peritoneal cavity, with escape of scolices or daughter-cysts, and secondary implantation. Moreover, there is enough positive evidence to warrant such belief, apart from mere hypothetical probability.

Now, what is the essential difference between an example of multiple peritoneal hydatidization and a multilocular hydatid of the liver or the lung? The difference is in the *locus*, in the size of the cysts, in the wider separation, as a rule, of the individuals, and in the absence of crumpling or distortion generally. If we can imagine a very heavy seeding of a part of the liver or of the lung, the result of a shower or swarm of embryos, all of which become implanted at too close quarters, they attempt to grow, they embarrass and interfere with one another's free growth and food supply just as they embarrass also the tissues of the host. Individual cysts remain small from deficiency of food-supply, they are distorted from mutual pressure, they are in immediate cuticular contact to a very large extent by bunching within a common adventitia, adjoining bunches being partly invested and partly separated, the bunching being due to trabeculation of the investiture. The larger the mass, the poorer the food supply to the deeper parts and the greater the tendency to degeneration and softening as the centre is approached. Now let us imagine again this heavy shower of embryos seeded, not into the tissues of liver or lung, but into the vastly more ample and generous *locus* of the peritoneal cavity. There is a large field, there is more opportunity of food supply in quantity, there is room to expand without distortion from mutual pressure, there is no need for central degeneration. Nevertheless, in heavily infected cases, and in parts, the individuals may be so numerous and the accumulations so great as to reproduce many of the features of a multilocular hydatid of the liver or lung, but in a milder degree.

Now, is it possible that the cause of multilocular hydatid disease of the liver and lung is analogous to what we know to be the cause of multiple peritoneal hydatids? I think I have submitted considerations which render it probable that the multiplication of cysts in a case of bone hydatid is due, at least in part, to rupture of fertile cysts and distribution of embryos therefrom. That is to say, a process is at work in bone hydatids similar to that which produces multiple peritoneal hydatids. I have not accounted satisfactorily for the first colonization of the bone, but it is evident that it had a beginning some time, whether as a secondary implantation by embolism from a previous cyst some distance away, or in the same way as a primary hydatid of the liver, perhaps as a single cyst developing in bone or near it.

As regards multilocular hydatid of the lung, I think we have fairly probable evidence in my case that embolic seeding played the principal part in its formation. If this was so in my case, then probably also in other cases. And if in the lung, it seems likely that something of the same sort may occur in the portal circulation and embolize the liver. Whether that be the mechanism or not, there exists positive evidence, in a case recorded by Graham, (20) that a hydatid cyst may rupture into the portal vein. This patient died as a result, and the condition was discovered at the post-mortem examination. It is possible to imagine minor cases of such inoculation where death would not be inevitable. However, I do not wish to be understood as suggesting such an occurrence as the probable solution. It is merely put forward as one of the things to think about when considering these questions.

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(20) Graham—"Hydatid Disease," 1891, p. 83.

Reports of Cases.

A CASE OF XANTHOMA DIABETICORUM.[1]

By **Rowland E. Harrold, M.B., C.M. (Edin.),**

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I am indebted to Dr. W. T. Hayward for the opportunity of showing this very interesting and rare skin condition, which has been ably described by Sir Malcolm Morris and other eminent dermatologists. For the notes of the case I am indebted to Captain Plummer, of the No. 7 Australian General Hospital, Keswick, South Australia. They are as follows:—

P.H.S., aged 23 years, was admitted to Keswick Hospital on July 30, 1919, complaining of weakness, loss of weight and frequency of micturition.

He enlisted in January, 1916. He had had no illness or accidents during his period of service. He stated that his weight before leaving England was 65.5 kilograms. On the voyage he grew weak and developed a thirst and commenced to pass more urine than normal. His vision was good. His father died of pneumonia; he did not know his father's age at the time of his death. He had two brothers and two sisters, all healthy. His mother was alive and healthy.

On entry to hospital he was obliged to pass water three or four times during the night. His weight on admission was 55 kilograms. Sugar was present to a marked degree. He was put on to antidiabetic diet and codeine (0.12 grm.) twice a day. The quantity of urine voided in twenty-four hours remained between 3,100 and 3,650 c.cm. during the first week spent in hospital. Restricted diet was then instituted on one day in each week (one litre of tea for the twenty-four hours only).

The quantity of urine per diem was reduced to about 2,240 c.cm. during the next week. In the following week it averaged about 1,400 c.cm.. All these specimens contained sugar, but the patient's condition improved as regards frequency and thirst, until he regarded himself normal in both respects. During the first five weeks in hospital he was kept strictly in bed.

On September 6 he was granted one month's holiday; he still observed the strict dieting, with one day per week fasting, but the codeine was discontinued. He returned to hospital on November 10. His weight was 51.5 kilograms. He felt weak, but had no undue frequency nor thirst.

About seven weeks before this date he noticed some hard, not tender papules on the left angle of the jaw. They were inconvenient during shaving, but otherwise gave him no trouble. About October 28 he noticed lumps on the back of his left elbow whilst washing. These lumps increased in size and number and a few days later similar lumps appeared at the back of the right elbow. A few days later he noticed similar lumps on the outer surface of each thigh, just above the knees. These lumps increased in size and number and spread down each leg below the knee. During the last few days they have appeared on the back of both thighs.

On examination, he was found to be a thin, pallid boy. He denied a specific infection. There was no testicular atrophy. At the angle of the jaw on the left side there were a few indurated nodular papules. They had been injured during shaving and bled fairly freely, but there was no purulent discharge. A similar condition was present on the right side, but of more recent origin. There was one on the right eyebrow and several large ones, almost the size of peas, on the back of the neck. On the extensor surface of both elbows, over a wide area, the shotty growths were very plentiful. At the first glance at the condition the similarity in appearance to that of *molluscum contagiosum* was noted. The rapidity of growth and true configuration on closer inspection soon dispelled this impression. It was easy to distinguish the condition from chicken-pox, as there was not an inflammatory areola around each spot. The papules were spread over a wide area on the extensor surfaces of both thighs and legs and backs of thighs and buttocks.

The developement of lesions was rapid. A small papule of the colour of the skin, with a distinct shotty feel increased in size rapidly to that of a small pea; they remain very distinct and discrete. The papules acquired a pinkish tinge, with steep edges, and the older lesions were in some instances tender on pressure. No pus could be extruded from these fleshy nodules, but where pressure or other irritation had been employed, they became brown on the top and an oily substance was expressed. They did not give rise to any subjective symptoms, unless irritated by pressure of clothing or friction.

The prognosis depends upon the sugar content, which is still present. If this can be cleared up, they will disappear rapidly and will leave no trace behind, which seems surprising from the size and depth of the lesions. If the sugar content persists, the lesions may remain for several years, but will probably not cause the patient more distress than that due to their appearance and the knowledge of their presence.

A biopsy was made of one of the lesions, but only an increase of fibrous tissue cells of large size was noticed. Some of these cells undergo an oily change, swell and break down in a few of the older lesions.

[1] Read at a Meeting of the South Australian Branch of the British Medical Association on November 27, 1919.

In Bulletin No. 26 of the Federal Quarantine Service it is stated that the number of cases of influenza notified during the first week in December in New Zealand was 234. During the preceding 12 days 407 cases were notified. In South Africa there were 533 cases and 104 deaths in the first fortnight of December, as compared with 708 cases and 146 deaths during the last three weeks of November. No cases of *encephalitis lethargica* have been reported in New Zealand since the first week in October.

The Board of Management of the Perth Public Hospital for the year 1920 has recently been elected. The members are Mr. G. Taylor, M.L.A., Mr. F. D. North, Dr. R. C. Everitt Atkinson (the Principal Medical Officer), Mrs. J. Cowan, Mr. J. T. Davis, M.L.A., Mrs. H. W. Rischbieth, Mr. K. B. Hawkins and Mr. C. S. Nathan.

The Medical Journal of Australia.

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A Retrospect.

(IV.)

Ophthalmology.

During the past few years ophthalmologists, in common with practitioners in other special branches of medicine, have concentrated the greater part of their attention and energies to the problems arising out of the war. As a consequence the progress of ophthalmology, as reflected in the literature received in Australia during the year 1919, has been relatively small. A distinct advance has been made in the plastic surgery of the ocular appendages. The work of Major Gillies and his colleagues at Sidcup has demonstrated the possibility of remedying some of the most hopeless-looking disfigurements of the face and orbit. The surgeons at Sidcup have made good use of the Esser epithelium inlay method of skin grafting. This method consists in burying at the required situation a piece of dental wax, moulded to the shape of the cavity and covered by a Thiersch graft. The second stage of the procedure involves an opening up of the pocket and the removal of the mould. The epithelium is not disturbed. Experience has proved that the Thiersch epithelial graft has a wide applicability and is of inestimable value. Pedunculated grafts, it is true, are still used in certain specially suitable cases and yield excellent results. As a result of this work, it has been shown that contracted sockets and cicatricial distortions of the eye-lids, once the despair of surgery, may now be attacked with a good prospect of success.

Closely related to this work is that connected with the determination of the best method of removing an eye. Valuable contributions have appeared from the pen of several French ophthalmic surgeons on this subject. The object aimed at is to provide a movable and pleasing artificial substitute for the lost eye. Simple enucleation has been almost abandoned in favour of one of the many forms of evisceration or of the implantation of a stump for the prothesis.

Sympathetic ophthalmitis has become an extremely rare condition. L. Weekers, of Liège, has suggested that this was true even before the war and that there are signs that the condition is disappearing.

A close study has been made of concussion effects on the ocular tissues, induced by projectiles traversing adjacent facial bones or by aerial condensation and rarefaction. F. Lagrange, in a recently-published atlas, has illustrated these effects, which include macular and paramacular hæmorrhages and effusions and choroidal rupture and hæmorrhages.

For the extraction of metallic foreign bodies from the eye-ball the ring magnet of Mellinger is rapidly replacing that of Haab. Good results are being obtained by its means.

Pædiatrics.

The literature dealing with pædiatrics reveals a singular absence of important advances. The amount of work undertaken in connexion with the physiology of digestion in infants, with the pathology of disturbances of the digestive, secretive and excretive tissues and with the clinical manifestations of infective processes, has been considerable. Some original work on the metabolism of fat has been carried out both in breast-fed infants and in infants receiving a mixed diet. It has been shown that the fat absorption increases proportionately with the amount of solid food ingested. In chronic intestinal affections the fat loss is found to be high. The amount of fat dealt with in the body does not differ materially when vegetable or animal fats are employed. It is known, however, that the vegetable fats are deficient in vitamines. Attention has been paid to the vitamine content of both fresh and dried fruits and vegetables. Ordinary drying does not diminish to an appreciable extent the amount of vitamine. The addition of alkali, however, leads to an apparent loss of vitamine. It is stated that cows' milk contained relatively little vitamine. Many clinicians have concluded from this that it is essential to add fruit juice or vegetable infusion to the diet of infants who have to be fed artificially.

There have been several case records of influenza in infants during the recent epidemic. The disease affected large numbers of children. Even the newborn have been attacked. Reports of influenzal implication of the brain, meninges and kidneys have

been published. It should be recognized that the pathology of these affections is somewhat obscure and until the virus of influenza has been definitely determined, it is inadvisable to assume that these complicating processes are influenzal in nature. In children suffering from influenza, a leucopenia has been shown to exist. Some clinicians have advocated vaccines both as a preventive measure and as a therapeutic agent. The vaccine favoured for these purposes contains influenza bacilli, pneumococci, streptococci and other bacteria isolated from the sputum of patients. No actual evidence has been offered in support of the claim that vaccines either reduce the incidence or diminish the mortality of influenza among children.

Pædiatrists have now accepted the general rule in the treatment of pyloric stenosis that surgical intervention should be instituted at an early stage. It has been shown that the mortality is considerably lower when the trial given to medical treatment is limited to a period of not more than two weeks. Rammstedt's operation is the procedure in almost universal usage.

In the treatment of constipation in infants and young children, the practice of employing massage, appropriate dieting and in some cases extracts of glands of internal secretion is rapidly replacing the use of drugs and enemata. Drugs are being discarded as well in the treatment of enuresis. In many cases drugs fail to effect a cure. On the other hand, it has been demonstrated that treatment by suggestion and the establishment of a "dry habit" lead to satisfactory results in previously obstinate cases. In some cases irritation of the neck of the bladder by bougies or by rhymically interrupted faradic currents for 15 minutes daily often produce excellent results in the course of a few weeks. In the treatment of congenital syphilis some valuable observations have been carried out. Various preparations of mercury have been tested and the methods of administration carefully controlled. It has been found that after injection or inunction mercury is excreted in irregular amounts for about nine days. When mercury is given by the mouth for four days, the urine contains the metal for a further eight days. This is regarded as distinct evidence of accumulation. It is therefore held that there is a tendency at the present time to give too much, rather than too little of this drug.

Many clinicians have recorded good results following the employment of auto-serum in the treatment of chorea.

Some important physiological investigations have been undertaken with the view to the better understanding of the functions of the thymus gland. The thymus of dogs has been extirpated and it has been shown that this gland is not essential to life in the dog. Its removal does not give rise to any detectable change in the hair, teeth, contour of the body, muscular developement, strength, general activity or intelligence of the animal.

Biological Chemistry.

Bio-chemists have carried out during the past year a large number of investigations dealing with problems of metabolism. Many of these researches are concerned with the rôle of accessory food factors. At the Lister Institute of Preventive Medicine A. Harden and S. S. Zilva have studied the relationship between lemon juice and the prevention of scurvy. They have succeeded in separating the bulk of the citric acid from lemon juice without diminishing appreciably the anti-scorbutic properties of the residue. They have fed guinea-pigs with different quantities of treated lemon juice which has been freed from citric acid by treatment with calcium carbonate and alcohol. About 2 c.cm. have been sufficient to maintain the weight of adult guinea-pigs at a constant level. The treated lemon juice does not retain its anti-scorbutic properties after remaining 14 days in the ice chest. These properties are also completely lost after the evaporation of the treated juice to dryness at 40° C.. These authors have succeeded in producing in monkeys a disease which is almost identical with the scurvy of human beings. The monkeys have received a diet lacking in the anti-scorbutic element, but theoretically complete in all other respects. The administration of treated lemon juice by subcutaneous injection to guinea-pigs suffering from scurvy did not prevent the progress of the disease or lead to any alleviation of the condition of the animals. On the other hand the administration to a monkey, suffering from scurvy, of treated lemon juice in amount corresponding to one litre of fresh lemon juice, led to rapid improvement in five days. During the course of this inquiry it became evident that the different opinions held in regard to the efficacy of

lemon juice in preventing the onset of scurvy are due to differences in the nature of the lemon juice. Lemon or lime juice, made from Mediterranean lemons or limes, is endowed with potent anti-scorbutic properties, but the West Indian lime juice has little power in this respect.

Some experiments have also been made at the Lister Institute of Preventive Medicine by Messrs. E. M. Delf and R. F. Shelton on the anti-scorbutic and on the growth-promoting of cabbage. They have paid particular attention to the effects of cooking upon these qualities. They have found that 70% of the anti-scorbutic factor is lost during one hour's cooking at 60° C. and over 90% during an hour's boiling. It would appear that vegetables should be cooked for a short period at a high temperature rather than for a long time at a lower temperature, when it is desired to preserve their anti-scorbutic qualities. Desiccation is also destructive to the accessory food factor and dried cabbage contains practically no antidote to scurvy. The workers in the Lister Institute are all convinced that scurvy is produced by the absence of a sufficient quantity of an accessory food substance from the diet. This vitamine is different from the fat-soluble substance which promotes growth, and from the water-soluble anti-neuritic hormone. They are satisfied that scurvy is not caused by an unsuitable physical state of division of the food.

An attempt has been made by A. Distaso and J. S. Sugden to show that indican and similar substances are found in the urine as a result of the activity of intestinal microbes. These investigators have succeeded in demonstrating that ethereal sulphates appear in the urine when the flora of the alimentary canal contains predominately germs which produce indol, whereas these sulphates are absent from the urine when the flora of the bowel is transformed so that organisms which do not produce indol are in the ascendancy. By adding lactose to the diet of white rats the development of *Bacillus bifidus communis*, an organism which does not produce indol, occurs within the intestine. In this way it has been possible to control the putrefactive changes in the food.

Some interesting results on the developement of immunity have been published by S. S. Zilva as a result of experiments upon animals suffering from various disorders due to defective nutrition. This investigator has produced a series of nutritional disturbances by feeding rats and guinea-pigs upon rations in which an inorganic element, such as calcium, iron or phospherous, has been diminished, or from which one of the three accessory food factors has been absent, or in which the sole source of protein has been deficient in one of the amino acids. The general results of this research work, which has been controlled in an adequate manner, is that deficient nutrition does not interfere with the formation of agglutinins and amboceptors.

Some studies on the amount of oxygen in venous blood have been made at Copenhagen by Christen Lundsgaard, who finds that the amount of oxygen in venous blood is dependent on the rate of metabolism of the tissues drained by the vein from which the blood is withdrawn, upon the rate of flow of the blood through the tapped vein and upon the volume of the blood flowing through the heart during each minute. It appears that the amount of oxygen, removed from the blood during its passage through the capillaries of the body in resting persons, is independent of the total oxygen capacity of the blood. It would thus seem that an anæmic patient does not need any compensating mechanism in respect to the carriage of oxygen by hæmoglobin until the colouring matter of the blood has fallen to less than one third of its normal value. When this limit is passed the output is increased.

During the year steps have been taken by the bacteriologists of Great Britain and Ireland to secure uniformity in the reactions of bacteriological media. It has been customary to express the reaction of culture media in terms of the amount of normal or decinormal solution necessary to bring the medium to neutrality. Experience has, however, shown that these titrations do not give the true reaction when carried out in media of different compositions. The reaction of any fluid is measured by the concentration of hydrogen ions present in it. In ordinary laboratory practice sufficiently accurate measurements of the number of hydrogen ions may be obtained by colorimetric methods. A report has been prepared proposing standard methods for preparing solutions

of definite acidity. A series of indicators are suggested which indicate variations in acidity from pH = 1.2 to pH = 9.6. These indicators include thymol blue, cresol red and bromcresol purple introduced by Clark and his collaborators. For concentrations in which the reaction does not vary much from that of distilled water the report recommends the use of mixtures of solutions of sodium phosphate (B.P.), and of acid sodium phosphate. It is hoped that the introduction of these methods and their adoption by the majority of bacteriologists will do much to produce uniformity in the results of the examination of bacteria. Not only will the use of indicators control the initial reaction, but it will provide a means of following the changes in reaction in the medium during the multiplication of the bacteria.

THE MEASUREMENT OF ATMOSPHERIC CONDITIONS.

It has been usual to employ the readings of the dry-bulb thermometer for estimating the climatic conditions of different places. The thermometer has also acquired authority for the purposes of controlling the warmth and ventilation of rooms and halls. The dry-bulb thermometer records the average temperature of the piece of wood to which it is attached, influenced as it is by the temperature of the objects around it and of the air in which it is suspended. It affords no measure of the radiant heat which will fall on the surface of the human body placed in the same position, and it fails to register the rate of cooling of human skin. The studies of physiologists show that it is not the actual temperature of the air, but the cooling power of the air, the radiant energy received on the skin and the drying capacity of the atmosphere which will excite the cutaneous nerve-endings and give rise to sensations of cold and warmth The cooling power of the air depends not only upon its temperature, but far more on its movement. Radiations fall on the skin sometimes from the sun and sometimes from other sources of heat. The drying capacity of the atmosphere is affected by the humidity, by the wind and by the radiations reaching the skin.

Meteorologists are accustomed to supplement the readings of the thermometer by a determination of the humidity of the air. The humidity is stated as the percentage of saturation. The percentage of saturation with moisture in the air is obtained by calculation from the records of a wet-bulb thermometer or from measurements of the dew-point. Meteorologists endeavour to make their readings comparable by placing their instruments in similar positions in the open and by protecting them with similar screens. While some measure of accuracy may be claimed for these indications of the climatic conditions of different places, it is found impossible to use them for controlling the ventilation of rooms in factories. The record of the temperature is obviously unsuitable. A room in a factory with a temperature of 80° F. is pleasant when the external temperature is 110° F. and the humidity less than 20%, but a room at 80° F. may be oppressive in the extreme with an external temperature of 80° F. and the humidity more than 80% saturation. The suggestion has been put forward that the readings of the wet-bulb thermometer be used for controlling the ventilation of rooms, mines and other enclosed spaces and that these readings be taken with the thermometer in rapid motion in the air. Such readings are found in practice to be unreliable. They do not correspond to the sensations of the human body nor do they indicate the capability of a person working in the atmosphere. In some situations, as in mines, where the movement of the air is kept at a more or less constant rate, these readings of the wet-bulb thermometer have more significance.

Some years ago Leonard Hill called attention to the advantages of the kata-thermometer for registering atmospheric conditions. He has recently supplied additional information about this instrument in a special report from him as Director of the Department of Applied Physiology of the Medical Research Committee. This report[1] deals with the science of ventilation and with treatment in the open air. A kata-thermometer is used to measure its own rate of cooling and is employed in the present instance to record its rate of cooling at temperatures approximating to those of the human body. In practice the instrument is used to measure the time occupied in cooling from 100° F. to 95° F.. These thermometers are alcohol thermometers with large bulbs 4 cm. long and 2 cm. in diameter fitted with a small reservoir at the upper end of the stem. They are heated well above 100° F. and allowed to cool in the position in which the observation is needed. It is necessary to heat them sufficiently to establish a regular rate of cooling. With a watch the time taken by the meniscus to travel from the 100° F. level to the 95° F. level is measured in seconds. By calculation the heat lost is expressed in micro-calories per square centimetre per second. This rate can be determined readily by a factor from the number of seconds occupied by the thermometer in cooling from 100° F. to 95° F..

Dr. Leonard Hill contends that these figures give a reliable index to climatic conditions in respect to human persons. He uses wet and dry kata readings. The difference between them gives the loss of heat due to evaporation, while the dry readings measure heat lost by radiation and by convection. Instead of describing the atmospheric conditions by temperature and by humidity, admittedly an incomplete method of description, he would employ a single figure expressing the loss of heat. As an example there may be given the records of three days on the east coast of England. On these days the readings of the dry-bulb and wet-bulb thermometers were for practical purposes identical, so that the temperature and humidity appear the same. The kata readings were for the dry bulb 60, 30 and 15 and for the wet bulb 90, 60 and 30. On the first day the wind was from the north and strong. The observer needed two overcoats

[1] The Science of Ventilation and Open-Air Treatment, Part I., Special Report Series, No. 32. Medical Research Committee, National Health Insurance, London; 1919.

and the cold was painful to the face. On the second day the weather was bright and sunny after frost with some wind. The observer needed an overcoat. On the third day there was a mist and the weather was quite calm. The observer wore no overcoat, but felt chilly on standing still. It is obvious that the kata-thermometer detects the difference which affects the temperature of the human body. Further knowledge of the employment of these instruments will be awaited with interest.

THE QUANTITATIVE ESTIMATION OF CARBON MONOXIDE IN BLOOD.

Coal gas or other forms of carbon monoxide poisoning is by no means uncommonly encountered in practice. In these cases it is of importance to ascertain the amount of carbon monoxide in the blood. Hitherto three groups of methods have been introduced for the quantitative estimation of the carbon monoxide content of blood. The first is the direct measurement of the gas contained. The method of Zuntz and Plesch consists in freeing the carbon monoxide and oxygen from 1 c.cm. of blood by potassium ferricyanide. The gases are then burned to convert the carbon monoxide to carbon dioxide. This gas is absorbed in potassium hydrate and the carbon monoxide is calculated from the reduced amount of gas. The second group of tests is the colorimetric. Haldane used a standard carmine solution, having the same colour as saturated carbon monoxide hæmoglobin. The sample of blood is matched with blood to which the carmine solution is added. The quantity of carbon monoxide is calculated from the amount of carmine solution needed. This test has not satisfied some observers and it is usual to substitute for the carmine a solution of hæmoglobin saturated with carbon monoxide. Lastly, the spectroscopic tests have been employed. These tests, however, have not yielded very accurate results. In these circumstances Dr. Donald D. van Slyke and Dr. H. A. Salvesen, working at the Rockefeller Institute for Medical Research, have sought to devise a simple yet reliable gasometric analysis for carbon monoxide hæmoglobin.[1] They found no reason to depart from the method utilized by Zuntz and Plesch of liberating the oxygen and carbon monoxide by means of ferricyanide. The gas is then collected in a Torricellian vacuum in a special gas-collecting apparatus. The oxygen is absorbed in the usual alkaline solution of pyrogallic acid. A correction has to be made for the trace of nitrogen constantly present in the blood gases. The exhaustion is continued until the volume of gases in the apparatus is constant. Then the pyrogallic acid and potassium hydrate is introduced. If any difficulty is experienced in reading the meniscus owing to the dark tint of the pyrogallic acid solution, a little water may be introduced above the upper level of the fluid. In this way the readings will be correct to about 0.002 c.cm.. It is shown that the method yields results which are accurate to within 1%. The investigators have found that when the percentage saturation is small, it is advisable to use three or four cubic centimetres of blood, as the error will increase in inverse proportion to the amount of carbon monoxide in the blood.

[1] *The Journal of Biological Chemistry*, November, 1919.

ABDERHALDEN'S PREGNANCY REACTION.

As a practical method of diagnosing pregnancy Abderhalden's ferment reaction has long since ceased to claim attention. Various theoretical and clinical objections have been put forward and, while some of the former have been met, the procedure is not sufficiently reliable to awaken the confidence of obstetricians. There is, however, a scientific basis for the contentions which were put forward by Abderhalden. It is undoubted that his dialysis and his optical methods actually do demonstrate the presence of ferments which are absent from the body under normal physiological conditions, apart from pregnancy. The actual significance of these ferments may be questioned but their presence has been established. Dr. W. M. Crofton offers some criticial ideas in connexion with this reaction and incidentally refers to the theories of Beard on the alleged alternation of generations.[1] Dr. Crofton points out that before a protein can give rise to a ferment endowed with the power of hydrolysis, it is necessary for the protein to be foreign to the organism into which it is introduced. In these circumstanses he fails to understand how placenta or even a human spermatozoon could produce a ferment within the tissues of a woman's body. On theoretical grounds, therefore, Abderhalden's reaction would be non-specific. Another consideration bids him pause before he puts forward such a view. He holds that unless a ferment or immune body active to the cells of the chorionic villi is present, chorion epithelioma is likely to result. Beard suggested that when the egg is fertilized and divides, some of the cells form a larva from which the fœtus arises by an asexual process. Other cells form germ cells and subsequently develope into ova and spermatozoa. In other words he extends the doctrine of somatic and generative cells by postulating an alternation of generations of cells. The phorozoon or asexual generation yields no spore cells from which a fœtus can arise. According to Beard cancer cells belong to this group. Dr. Crofton suggests that, while the cells comprising the greater part of the placenta, are derived from the germ cells, the syncytial cells are derived from the larva and are consequently foreign to the body itself. Beard held that the cells of one generation could live at the expense of the other and their ferments could hydrolyse the protein of the other. Normally the chorionic villi disappear as the fœtus grows. During this process ferments active to the cells of chorionic villi appear and it is these ferments that are demonstrated in Abderhalden's reaction. In these circumstances he is prepared to accept Abderhalden's test as evidence of early pregnancy, provided that chorionic cells are employed as the antigen in the reaction and further provided that the presence of the antibody or ferment is demonstrated by a complement fixation.

The annual cricket match between the members of the honorary staffs of the Sydney and the Royal Prince Alfred Hospitals will be played at the Rushcutter's Bay Oval, Sydney, on Wednesday, January 28, 1920, at 2 p.m.. These matches have been discontinued since the outbreak of war. We have been requested to state that past and present students of these hospitals are cordially invited to attend.

[1] *The Dublin Journal of Medical Science, January*, 1919.

Abstracts from Current Medical Literature.

DERMATOLOGY.

(26) Amœbiasis Cutis.

M. F. Engman and A. S. Heithaus report a case of amœbiasis in a boy aged five years (*Journ. of Cutan. Diseases, incl. Syphilis*, November, 1919). The child presented, on admission to hospital, an ulcerated lesion on the left side of the body, about the size of a large saucer. The lesion was scalloped in outline and of a deep, dusky, purplish-red colour. The border was peculiar, being rolled, undermined and slightly infiltrated. There were no small peripheral pustules or papules of any kind and the ulcers seemed to extend by an undermining process, especially located in the cutis. Similar, though smaller, ulcers were present on the right buttock and on both legs. The initial stage of the development of these ulcers was observed on the leg, where the process commenced as a small, deep-seated abscess, which broke and extended peripherally, the central part becoming necrotic. After admission to hospital, the patient developed diarrhœa, with blood, pus and mucus in the stools, which disclosed on examination numbers of amœbæ. Similar bodies were found in the pus from the skin ulcers, as well as in fluid aspirated from the chest. The temperature at this time was 40° C. and the pulse-rate 150. but after a subcutaneous injection of emetine the temperature fell to normal and the pulse changed for the better. Another injection of emetine was given the following day and the temperature remained normal for a week, the leucocyte count dropped from 33,000 to 11,000 in four days and the diarrhœa ceased. The most remarkable feature, however, was the change in the skin lesions. The edges of the ulcers became flattened, pus ceased to appear at this point on pressure and islands of epithelium began to appear everywhere on the surface of the ulcers and spread like magic. A few weeks later the child developed a profound septic condition and death rapidly supervened. The authors are of opinion that they were dealing with an amœbic affection of the skin, inoculated with infected hands or nails upon a bullous impetigo, which the child had prior to the ulcer.

(27) Pityriasis Rosea.

William P. Cunningham calls attention to the necessity for the general practitioner to have a clear conception of the clinical manifestations of *pityriasis rosea*, as it occasionally closely simulates syphilis (*Medical Record*, September, 1919). The salient features of this disease are its occasional constitutional disturbances, consisting of slight elevation of temperature, with soreness of the cervical glands, and perhaps an ephemeral pharyngitis. The cutaneous eruption shows a predilection for the back, chest and sides. When it is profuse, it will spread to the neck and arms and downwards upon the abdomen, buttocks and legs. Sometimes, whimsical in distribution, it will avoid the trunk and involve the limbs. A large lesion usually precedes the main eruption, commonly described as a herald patch; it is situated usually upon the flank or abdomen. The eruption consists of patches, varying in size from that of a small papule to that of a shilling piece. The outline may be circular. oval or irregular. They are slightly scaly. Their colour is pink at the periphery and fawn at the centre. Some are of deeper hue, being red at the periphery and salmon at the centre. The scaliness may show itself only in a slight crinkling of the surface, resembling that of cigarette paper, or the epidermis may be turned up in a little cuff, separating the darker rim from the shading centre. The latter feature is sometimes regarded as pathognomonic. Intensity of the morbid process may cause the evolution of papules appreciably elevated above the surrounding skin. These are of a darker hue and do not present the nuances characteristic of the typical cases. They are somewhat scaly and it is their appearance which has sometimes led to the embarrassing diagnosis of lues.

(28) Lupus Erythematosus.

William D. Small describes a simple method of treatment for *lupus erythematosus* of the localized variety, whether situated on the face, scalp, ears or hands (*British Journ. Dermat. and Syphilis*, July-September, 1919). The method adopted is as follows: The part to be treated is first gently washed with ether and allowed to dry. It is then vigorously rubbed with a mixture of *ac. carbolici liq.*, one part, *ac. lactici fort.*, four parts, by means of a glass rod. A few drops only are applied at a time and the rubbing is continued until practically dry, which is usually in about two or three minutes. The patient is directed to leave the part alone if he has no discomfort, but if slight irritation developes, to apply vaseline constantly. This treatment may be followed immediately by a slight inflammatory reaction and in a few days by desquamation. The application should not be repeated more than once a week, or preferably until exfoliation is completed and until the inflammatory reaction resulting from the previous treatment has entirely subsided. It is claimed for this method that its application is of great simplicity. It is relatively painless, the resulting scarring is very slight, the results achieved are extremely satisfactory and the cosmetic effects are excellent.

(29) The Radiological Diagnosis of Appendicitis.

In dealing with the value of Röntgen rays in the diagnosis of acute appendicitis, George F. Pfahler does not claim that all cases should be subjected to radiological examination, although in cases where there is possibility of ureteral calculus or of pneumonia such an examination is called for (*Amer. Journ. Röntgenol.*, February, 1919). Chronic appendicitis gives rise to many obscure digestive symptoms, and many cases of dyspepsia of long standing are due to this cause. The technique of the examination is that of the ordinary opaque meal, a moderately fluid meal of about 60 c.cm. or more of barium sulphate suspension being given in butter-milk. The patient is seen directly after the meal and again at four, six, eight, twelve, twenty-four and forty-eight hours after the meal. No purgative is allowed until the examination is complete. A barium enema is also given, as this clearly demonstrates the position of the colon in relation to the other organs and the appendix. Localized tenderness over the appendix is sought, as is mobility or fixation of the caecum; in the absence of localized tenderness over the appendix shadow and with a mobile caecum, appendicitis can be excluded. The appendix can be demonstrated in the majority of cases and the presence of kinking and adhesions demonstrated. An incompetent ileo-caecal valve can be demonstrated by the fact that after 24 hours the ileum is generally empty, and yet at the end of 36 hours it again contains some of the opaque meal. This definitely points to ileo-caecal valve incompetency.

(30) The Radiological Diagnosis of Prostatic Calculi.

M. J. Huberry (*Americ. Journ. Röntg.*, June, 1919) divides prostatic calculi into two classes, *viz.*, those forming in the gland itself and those carried down from the upper urinary passages; the latter are really calculi of the posterior urethra. Prostatic calculi contain over 80% of phosphate of calcium. A large investigation showed calculi in the prostate in 13% of men over 45 years. These calculi are extremely common in skiagrams and show as collections of small shadows or as distinct single shadows. They are very difficult to distinguish from ureteral calculi or from calcified glands or even phleboliths.

(31) Normal Ossicle Diagnosed as Fracture.

Howard Pirie describes an unusual ossicle which occurs in the foot (*Archives of Rad. and Electrotherapy*, August, 1919). This ossicle is frequently diagnosed as a fracture of the navicular. It occurs between the talus and navicular on the dorsum of the foot and frequently a small articular surface is found on the navicular, with which this ossicle articulates. To prevent error in diagnosis, the opposite foot should be examined, as the condition is always bilateral.

BIOLOGICAL CHEMISTRY.

(32) The Effect of Hæmorrhage on Alkali Reserve.

M. V. Buell (*Journ. Biologic. Chemistry*, November, 1919) has undertaken a study of the effects on amount of reserve alkali in pigs after repeated bleeding. Three different methods were employed in estimating the alkaline reserve values. The first was the open vessel method, in which the blood was

collected in an open Erlenmeyer flask containing sufficient potassium oxalate to prevent clotting. The second method involved the use of a separator funnel and was soon abandoned because the results were more difficult to reduplicate. The third method, called the alveolar air method, apparently yielded results which were not strictly comparable to those obtained by the first or second method. It was used to control and amplify the information obtained by the first method. Anæsthesia was eliminated, but another disturbing factor was introduced in individual cases, namely that of struggling. The author found that the loss of carbon dioxide during fixed periods of standing after the blood has been withdrawn bears a definite relationship to the initial amount. She was consequently able to estimate the alkaline reserve values by calculation from samples that had stood for a known time before analysis. When pigs were bled to the extent of 1.3% of their body weight, a lowering of the reserve alkali followed within the first few hours. When the animal remained quiet during the bleeding, the drop in alkaline reserve was invariably small. After struggling a considerable increase in the drop was found. The maximum decrease was reached within 30 minutes of a bleeding, when no struggling had taken place. She records wide variations in the drop in different animals and in the same animal after repeated bleeding. She kept pigs on an insufficient diet of corn and water and bled them seven times at intervals of five days. The alkaline reserve values after each of the bleedings bore no relationship to the values after the other bleedings. The amount of blood withdrawn did not determine the loss of reserve alkali. After each bleeding there was a fall in the total nitrogen content of the blood, but the urea and non-protein nitrogen tended to rise. Even with an insufficient diet, there was a distinct tendency toward the regeneration of the blood proteins after repeated bleedings.

(33) The Glycerophosphoric Acid of Cephalin.

The accepted doctrine of the constitution of cephalin embodies the conception that glycerophosphoric acid is contained in the molecule. Definite evidence of this has not yet been adduced. P. A. Levene and I. P. Rolf are prepared to accept the assumption and have endeavoured to obtain information containing the condition of the glycero-phosphoric acid (*Journ. Biologic Chemistry*, November, 1919). They start with the fact that the basic part of cephalin is amino-ethyl-alcohol. The amino group is free, while the alcoholic group is substituted. The glycerol contained in cephalin may be attached to the phosphoric acid either directly or to the amino-ethanol. As there is evidence that the amino group is free, the second alternative is ruled out. They regard this as *a priori* evidence of the existence of glycerophosphoric acid. They have further isolated this acid both from lecithin and from cephalin and record their experimental data in support of the contention of the identity of the substances isolated and of their chemical constitution. In the first place they obtained lecithin by decomposition of lecithin cadmium chloride with ammonium carbonate. The material was found to contain 20% nitrogen. After this material had been in contact with barium hydroxide for six hours at room temperature, the excess of barium was removed quantitatively with sulphuric acid. The filtrate was the concentrated and the barium salt precipitated by pouring the concentrated solution into absolute alcohol. The subsequent purification was carried out repeated resolution and re-precipitation. The substance obtained was a tan coloured, granular material. Further experiments proved that the colour was due to an impurity containing nitrogen. By gaining the lead salt of the acid, it was possible to remove the colour and at the same time the last traces of nitrogen. The lævo-rotation diminished as the purification proceeded. Ultimately a substance was obtained which yielded a rotation of

$$(\alpha)_D^{20} = \frac{-0.075 \times 100}{1 \times 18.42} = -0.63.$$

The elementary analysis satisfied the conditions on the assumption that it was glycerophosphoric acid. Similar experiments were carried out with cephalin and a pure substance was obtained by the lead acetate method. The formula corresponds to glycerophosphoric acid with one mol of water of crystallization.

(34) Nitrogen Metabolism After Hæmorrhage.

M. V. Buell, continuing her investigations in the subject of the regeneration of blood, has compared the changes in the metabolism of nitrogen after hæmorrhage with the amount of reserve alkali in the blood and records the results of her observations (*Journ. Biologic. Chemistry*, November, 1919). She has found that when a pig is kept on a diet of corn and water and is bled at relatively short intervals, the creatin excretion is definitely increased. This effect is said to be cumulative. In one experiment a pig was kept on a diet of starch and water with sufficient sodium chloride to render the diet palatable. The diet contained the minimum caloric supply. Two bleedings were undertaken. After the second bleeding air hunger appeared and the respirations became shallow and rapid. The pig died of hæmorrhage of the lungs. The author does not attribute the death to the experimental procedure. In this animal there was an increased excretion of total nitrogen, phosphates and creatin. She adds that the theory that hæmorrhages amounting to 13 c.cm. per kilogram body weight, are not necessarily accompanied by a severe degree of acidosis, is supported by the results of her observations. The loss of reserve alkali was slight and of short duration; there was no great increase in the ammonia nitrogen excretion after the bleedings; the hydrogen ion concentration of the urine was not influenced by the bleedings.

(35) Action of Ptyalin.

H. McGuigan (*Journ. Biol. Chemistry*, September, 1919) has studied the action of the ptyalin of saliva upon starch. He has used saliva as the source of ptyalin, but does not state from what animal the saliva has been obtained. Everywhere he speaks of ptyalin, but in the experiments uses saliva variously diluted. Glucose has been estimated in these experiments by the Lewis-Benedict method. A modification used by Meyers and Kiliani for measuring the diastatic value of the blood has been found useful in these studies for estimating the sugar formed in the reactions. In dilute solutions ptyalin acts on starch at a rate directly proportional to the amount of enzyme present. The products of the reaction soon interfere with the speed of the hydrolysis. The point of equilibrium is reached when about 70% of the starch calculated as dextrose has been converted into sugar. For practical purposes the same amount of sugar is formed from starch by the same amount of ptyalin whatever may be the concentration of the starch mucilage. The products which lessen the velocity of the reaction are not maltose or dextrose, but the author has not established their identity. Some evidence is advanced in favour of a hypothesis that ptyalin unites with starch and exerts a force causing hydrolysis.

(36) Acid Fermentation of Xylose.

Fred. Peterson and Davenport (*Journ. Biol. Chemistry*, September, 1919) have shown that xylose is readily fermented by bacteria derived from silage or cabbage or found in certain soils. All attempts to decompose xylose by means of micro-organisms usually studied in bacteriological laboratories failed; a number of yeasts as *Carlsberg I.*, *Burgundy*, *amara* and *Hansen* did not grow in media containing xylose as the sole carbohydrate; and *Bacillus mycoides*, *Bacillus subtilis* and *Bacillus azobacter* do not affect xylose. The bacteria fermenting xylose are easily isolated by inoculating an infusion of yeast containing xylose and making plates on xylose-yeast agar. On solid media these organisms grow slowly, producing dot-like colonies. Xylose is fermented in the presence of abundant oxygen or in a limited supply of air. The organisms grow along the whole length of an agar slab. In respect to reaction they withstand a wide range of acidity from thousandth normal to neutrality. The main products of fermentation are lactic acid and acetic acid and the products approximate to the quantities calculated on the assumption that xylose breaks up to form lactic acid and acetic. The fermentation occurs rapidly and the whole of the xylose disappears in 10 or 12 days, but the bulk of the sugar is destroyed in one to four days. Sugars other than xylose, such as glucose, sucrose, lactose and fructose, are fermented by these bacteria.

PUBLIC HEALTH WORK IN NEW SOUTH WALES.

(*Continued from Page 71.*)

The Waterfall State Sanatorium.

There are 366 beds in the Waterfall State Sanatorium, including 58 in the open air. During the year 1917 465 patients were admitted and, in addition, there were 339 patients under treatment at the beginning of the year. The number of patients discharged was 337, while 159 died. The patients were kept under treatment on an average for 197 days. The average is higher for the group of those discharged with their disease arrested and for the group of those who lutimately died. It is lower for the group of those discharged, either much improved, improved or unimproved.

It appears that of the 465 patients admitted during the year, 17 were in the early stages of pulmonary tuberculosis. The result of treatment in these 17 patients was that the disease was arrested nine times, that the condition was much improved five times and that some improvement was recorded three times. Dr. H. W. Palmer, the Medical Superintendent, describes the next group of cases as moderately early. There were 49 patients in this category and in 37 of them the disease was arrested. No death occurred among the 66 patients of these two groups. Arrest was achieved in 69% of these patients. By arrest is meant that there was no active sign of disease, that the temperature was normal, that the patient was coughing up no sputum and that he was able to do a moderate amount of work.

The unfortunate fact is apparent that the persons admitted to the Sanatorium with incipient or moderately early disease represent but 16.6% of the total number. The third class is represented by persons with moderately advanced pulmonary lesions. There were 187. Of this number, 30, or 16%, had their disease arrested. Twenty-three of the patients died, which represents 12.3% of the total number. The fourth class comprises 243 persons with advanced disease. It is surprising to find that arrest in the sense defined above was achieved in eighteen patients, which is equivalent to 7.4% of the patients in this group. The obverse of the story is found in the fact that 136 of the patients died before they were discharged. This represents practically 56%. Dr. Palmer points out again that it is of paramount importance to select patients for admission to the Sanatorium. He pleads earnestly for a more rational and effective method of dealing with this fatal disease. Use should be made of the experience gained, both in Australia and elsewhere, and systematic organization should be founded, similar to those in existence in Edinburgh and Baltimore. There are but two methods available to effect the necessary change in regard to this subject. The first is by propaganda, to educate the public and to impress upon it the necessity for the introduction of a complete plan of campaign. The second method would be to refuse admission to the Sanatorium of all persons whose disease has advanced beyond the stage in which treatment offers a reasonable prospect of permanent arrest. This action would necessitate the co-operation of two institutions. The first of these is an organization which would seek out from the community all cases of infective tuberculosis, while the second is an establishment where persons with advanced disease would receive palliative treatment to reduce their sufferings. Moreover, the Sanatorium should be amplified by the institution of farm colonies, where discharged patients would be enabled to remain well.

Rookwood State Hospital and Asylum for Men.

The Rookwood State Hospital and Asylum for Men at Lidcombe contains accommodation for 678 patients in the hospital division and 743 inmates in the asylum. On the first day of 1917, there were 1,276 persons in the institution. The number of persons admitted during the year was 3,111. The number of persons discharged was 2,568 and of those who died 480. The death rate of the total population of the institution was 15.6%. Of the 3,111 persons admitted 2,279 went into the hospital division, while of the 2,568 persons discharged, 1,834 were in the hospital division. All the deaths occurred in the hospital and, consequently, the mortality of the hospital population was 20.9%. The average number of patients in the hospital was 655 and the average cost per patient was £28 15s. 5d.. The hospital contains two wards with accommodation for 137 patients suffering from epilepsy and mental disorders. A patient, on being certified insane, is transferred to one of the hospitals for the insane. During the course of the year 1917 this occurred in 52 instances. Persons suffering from malignant disease or venereal disease are transferred to the Liverpool State Hospital. A few patients were transferred to other hospitals or institutions for particular purposes.

We note that the laboratory diagnosis work needed in connexion with the treatment of the patients, was carried out at the Micro-Biological Department and that all the X-ray work was undertaken at the Sydney Hospital. The X-ray equipment at the Sydney Hospital, however, was not capable of fulfilling all the requirements of a modern hospital and the wisdom of utilizing a department with indifferent equipment may be questioned.

A few structural alterations were undertaken during the course of the year. It is stated that these improvements have been highly beneficial to the welfare of the patients. In the hospital division there were two tents for persons suffering from pulmonary complaints. One of these tents was demolished during a severe gale and the other was badly damaged. The Medical Superintendent raises the question whether more adequate accommodation should be supplied or whether persons suffering from pulmonary tuberculosis should be transferred to sanatoria.

Appended to the report are lists of operations undertaken and of conditions treated in the various special departments. The resident staff consists of a medical superintendent or his deputy and an assistant medical officer. There are eight members of the honorary visiting medical staff, one dentist and two masseurs. It is remarkable that there is no honorary physician on the staff.

State Hospital and Asylum for Women, Newington.

The State Hospital and Asylum for Women at Newington accommodates between 700 and 800 inmates. It serves a purpose similar to that of the Rookwood Hospital. There were 704 women in the institution at the beginning of the year, including 302 in the hospital division and 402 in the asylum. The number admitted was 1,208, including 856 admitted to the hospital division and 352 to the asylum. The mortality of the patients in the hospital division calculated by the formula of the Registrar-General was 18.1% notwithstanding the statement that the number of deaths was equal to 10% of the "cases" treated. It is stated that the majority of the patients require skilled nursing, while the nursing staff is inadequate for its purpose. Much of the nursing has to be done by the untrained inmates. More accommodation is needed and the Medical Officer appeals for lock, isolation and admission wards. There were 50 patients suffering from various forms of syphilis and 23 from gonorrhœal infections. Many of the patients were suffering from mental affections and 181 from senility.

State Asylum for Aged and Infirm Men.

A short report is attached, dealing with the main facts in connexion with the State Asylum for Aged and Infirm Men at Parramatta. There were 667 persons admitted during the year, in addition to 174 who were inmates on the first day. The average number of inmates in the institution at any one time was 153. The average cost per head was £21 14s. 11d.. The visiting medical officer, Dr. W. S. Brown, paid 213 visits. He found it necessary to transfer 115 of the inmates to other institutions for medical treatment.

State Hospital and Asylum for the Blind.

At the State Hospital and Asylum for the Blind and Men Suffering from Defective Vision and Senility, Parramatta, 770 persons secured admission. The average number of blind men in the institution was 32. At this institution meals and beds are supplied to "casuals." There is a bakery attached to the institution at which 806,370 lbs. of bread and 34,180 lbs. of cake were prepared. The printer has made a serious error in placing a decimal point instead of a comma after the thousands in each number. It is stated that the quality of both was first class, notwithstanding the fact that it was possible to sell the bread at 1½d. per lb. and the cake at 1½d. per lb. to other State institutions. The clothing for

the inmates, with the exception of hats and boots, and the bedding used in the institution were all made under the supervision of the Matron. During the course of the year 73 of the inmates were transferred to other institutions for medical treatment.

Food Control.

The provisions of the *Pure Food Act, 1908*, are held by the Director-General of Public Health to be satisfactory and are strictly enforced. The Chief Food Inspector and his staff undertake the supervision of the milk supply, the supervision of the manufacture, preparation and storage of food for sale and the regular inspection of food in bulk. During the course of the year 3,241 samples of milk were taken in different parts of the State and submitted for analysis. In addition, 5,528 samples were taken by the municipal and shire inspectors. In the metropolitan district 369 out of 6,954 samples were found to be adulterated. Warnings were issued in the majority of cases, while 119 vendors were prosecuted and fined in the aggregate, £579 12s.. This is equal to an average fine of £4 17s. 5d. per individual. No information is given in regard to the tests employed to determine the adulteration of milk. If adequate precautions were taken to exclude from prosecution persons who sold milk of poor quality without any addition of water or other ingredient, the amount of the fines would prove valueless for the purpose in view, namely, the improvement of the milk supplied to the community. It is possible to conduct the business of a dairy profitably and at the same time to guarantee the purity of the milk supplied. The Talbot milk in Melbourne and elsewhere is absolutely satisfactory. On the other hand, it is notorious that the milk sold in Sydney and elsewhere from the ordinary dairies is dirty, contains an undue number of bacteria and is frequently adulterated. We cannot advocate an undertaking by the State to provide a pure milk, but we claim that the health authority should have power to insist that all milk offered for sale shall be collected mechanically and not by hand into sterile vessels, shall be chilled immediately after collection, shall be bottled into sterile bottles while still at a low temperature and shall be delivered in closed bottles directly out of an ice chamber. It goes without saying that the milch cows providing milk for sale should be examined from time to time, both by the tuberculin test and in other ways, and that all diseased animals should be excluded from the herds. The number of samples taken in the country was 1,815, of which 722 were taken by the Inspectors of the Department. The milk was found to be adulterated 164 times. Prosecutions were instituted 78 times and fines aggregating £349 8s. 3d. were imposed. The fines averaged £4 9s. 6d. per offender. It will be noted that 5.3% of the samples collected in the metropolitan district and that 9% of the samples collected in the country districts were found to be adulterated. Apparently no bacteriological examinations of milk are carried out as a routine measure, since only seven samples were examined bacteriologically at the Micro-Biological Laboratory. It is not stated what the result of the seven examinations was.

Samples of foods other than milk and drugs were also submitted for examination. There were 449 samples and in 133 instances the commodity was found to be below standard. In two instances condensed milk was unsatisfactory and in three ice cream was found to be below the standard. Out of 31 samples of butter, seven were rejected, although the impurity apears to have been sufficiently serious in only one sample to justify a prosecution.

The Government Analyst examined 230 samples of foodstuff supplied to the military transports, in addition to the samples collected in the ordinary way by the departmental inspectors. He found that 15 of the samples were adulterated. He further examined 1,715 samples submitted by State hospitals and subsidized charities, the Stores Supply Department, the Criminal Department, the Pharmacy Board, the Public Works Department and various other authorities. While the nature of these samples is given, Dr. Cooksey is silent concerning the result of his analyses.

A large quantity of deteriorated and damaged food was seized and destroyed during the year. Nearly 20 tons of tomato pulp, approximately 14½ tons each of flour, cocoa and dried fruit, seven tons of rabbits, five tons of biscuits, 2¾ tons of baking powder and 3½ tons of fruit and fruit pulp are included in the list. It is somewhat surprising to learn that, notwithstanding the very large amount of food destroyed, only 30 prosecutions were instituted. The fines amounted to the ridiculously low sum of £221.

During the course of the year the Inspectors visited 5,997 premises used for the preparation, sale or storage of food. This number of inspections is considerably higher than that of previous years. There were 1,221 restaurants and refreshment rooms in the list, 928 grocers' shops, 971 butchers' shops, 735 fruiterers' shops and greengrocers' shops, 485 bakeries, 388 small goods shops, 327 fish and oyster shops, 267 confectioners' shops, 119 cordial factories, etc.. Notices were served in 461 instances and prosecutions were taken out in 166. The total amount of fines amounted to £812. No further information is given concerning the distribution of the premises found to be unclean or otherwise unsuitable.

The Acting Chief Veterinary Inspector, assisted by 14 assistant inspectors, visited 10,841 dairies and inspected 335,631 cattle. The total number of cattle condemned was 773, including 537 suffering from tuberculosis, 154 from actinomycosis, 88 from cancer and seven from other diseases. The incidence of tuberculosis among the cattle examined was consequently about 1.5%. In addition, 19,560 cattle were inspected at slaughtering premises and 61 were ordered to be destroyed. Of these, 48 were tubercular. The incidence of tuberculosis among these animals was consequently 2.4%. The Acting Chief Veterinary Inspector states that, owing to the difficulty of procuring tuberculin, only 82 of the 355,191 animals inspected were tested. Of these 82, seven reacted; in seven cases the response was doubtful and sixty of the animals did not react. In these circumstances it would appear that the incidence of tuberculosis among the cattle must have been very considerably higher than is stated in the report.

The Dairies Supervision Staff were instructed by the Director-General of Public Health to meet in conference during the second week of April. A uniform method of dairy and slaughterhouse inspection was evolved, model plans for dairies and slaughterhouses were drawn up and the question of the best method of carrying out the provisions of the *Dairies Supervision Act* was discussed.

Sanitary Inspection.

The Chief Sanitary Inspector reports the work accomplished by himself and the three Assistant Sanitary Inspectors during the course of the year. Six new country town were inspected, in addition to 42 that had previously been controlled. The surprising statement appears in the report that "investigation was made into 21 small outbreaks of infectious disease and into several suspected individual cases." Surely it is waste of public money for a person trained to examine drains to carry out investigations that call for expert medical knowledge. The Inspectors carried out the usual work of controlling the night-soil and garbage depôts. The result of these inspections was a request by the Department to the local authority to prosecute the sanitary contractors for having neglected to comply with the ordinances. Apparently, the councils acceded to the request and convictions were obtained in each case. The work of rat catching was undertaken by several bodies. The employees of the Department caught 1,737, those of the City Council 5,512, those of the Federal Quarantine Department 882 and those of the Sydney Harbour Trust 244.

Microbiological Work.

Dr. J. B. Cleland, the Principal Microbiologist, presents a ponderous report, occupying 139 foolscap pages, in addition to charts, maps and plates. The information given in the first part of the report consists of an enumeration of the number of examinations undertaken and the general purposes for which they were made. There follows a list of culture media prepared, of materials used and of vaccines prepared. During the course of the year 78,408 c.cm. of anti-typhoid and mixed typhoid and para-typhoid vaccines were issued.

Part II. is a record of the fleas collected from rats and other rodents. None of the rodents examined were infected with plague. The remainder of the report is occupied by a very long article on "The Australian Epidemics of an Acute Polio-Encephalo-myelitis (X-Disease)." This article is a much extended edition of an article published in this journal on the same subject by Drs. A. W. Campbell, Burton Bradley and J. Burton Cleland on February 16, 1918.

LUNACY AND MENTAL DEFICIENCY IN SOUTH AUSTRALIA.

The Inspector-General of Hospitals of South Australia has issued, as usual, two reports dealing with the inmates of the Mental Hospital at Parkside, the second being the report of the Mental Defectives Board.

During the course of the year 1918, 240 persons were admitted to the Mental Hospital at Parkside and six were returned from trial. Of these 246 persons, 45 were males and 101 females. The proportion of admissions to population works out at 5.59 per 10,000 of population. The figure for the males is 6.90 and for the females 4.21. The proportion is the same as that for Victoria, although in the latter State the rate for males is 5.09 and for females 6.04. In New South Wales the admission rate is 7.56; in Western Australia is 6.61 and in Queensland 6.33.

The total number of patients under treatment at Parkside during the year was 1,422, which represents a decrease of 19 from the figure for 1917. The following details are given in regard to the patients on admission. The general bodily condition was good in 76 patients or 31.1%, was fair in 73 or 29.5% and was bad in 97 or 29.4%. One patient was under 15 years of age, four were between the ages of 15 and 20, 49 were under 30, 53 were under 40, 39 were under 50, 38 were under 60, 35 were under 70, 22 were over 70 and of five the age was unknown. Of the 246 patient, 112 were unmarried. During the course of the year 131 patients died, including 73 males and 68 females. The number of persons discharged was 137, of whom 109 were discharged as "recovered." The recovery rate (a very bad term) works out at 44.3% of the patients admitted. During the course of the year 11 patients escaped and 10 were re-captured. During the period of 72 years since the institution was founded, the recovery rate has varied between 41.1% and 69.7%. The average works out at 54.2%. On the other hand, it is shown that about 16% of those discharged have to be re-admitted at a later period. From the information given, it appears that the total number of admissions since 1846 is 11,609. Of these, 1,857 were re-admitted on account of relapses. The total number of persons, therefore, was 9,390. The number of deaths within the institution was 3,873. It therefore follows that there are 5,517 persons to be accounted for. On December 31, 1918, 1,153 of these persons were still in the Hospital. This would leave a balance of 4,364. Unfortunately the information given is insufficient to draw any further conclusion. It is extremely probable that many of these persons died insane, either in their own homes or in institutions in other parts of the world. The fact remains, however, that the statistics leave a class unaccounted for, which represents 46.5% of those committed to the care of the Hospital. It must, however, be remembered that the discharges include persons who still exhibit symptoms of mental disorder at the time of discharge.

Some further light is thrown on the question of the fate of the inmates. Of the 240 persons admitted for the first time, five were suffering from congenital mental defects, 132 were suffering from first attacks of insanity, 77 were suffering from attacks which were not the first, while in 26 it was unknown whether the attack was or was not a first attack. The attack of mental disorder during the course of which admission was effected had lasted less than two weeks in 60 out of the 240 cases. In 26 other patients it had lasted within two and four weeks, while in 82 it had lasted between one month and twelve months. In eight instances it had lasted for over three years. The number of previous attacks was unknown in 52 instances, was one in 18 instances, was two in six instances and was three in one.

The form of insanity is set out in a table. Senile dementia claimed the largest number of victims, namely, 36. The other forms of dementia, namely, organic and secondary, were represented in seven and 16 individuals respectively. There were 31 cases of recurrent mania, 24 cases of recent mania, five of *mania a potu* and four of chronic mania. Under the heading *dementia præcox* there were 14 cases of the hebephrenic form, 13 of the paranoidal form and four of the katatonic form. There were 21 cases of non-systematized delusional insanity and 18 of systematized delusional insanity. The number of cases of general paralysis of the insane was 10 and of confusional insanity 13. Of the patients with melancholia, eight had recent attacks, three involutional and two recurrent. There were three cases of stupor and one each of idiocy with epilepsy, moral insanity and volitional insanity.

The ætiological factors and associated conditions of the mental diseases are set out in a table. There is a primary division into congenital, first attack, not first attack and unknown whether first attack. Each of these primary headings is subdivided into principal and contributory. From the table we learn that heredity was a principal ætiological factor in 22 cases in those admitted in the year. In 39 instances alcohol played some part in the causation; it was the principal cause in 23 instances. Venereal disease is said to have produced the mental disease in 12 instances and to have influenced it once. Senility appears among the principal factors in the table in regard to ten cases, while a previous attack occupies the same position in regard to 21. We have on previous occasions expressed disapproval of the perpetuation of this obviously illogical assumption. A person does not become insane under normal physiological conditions even in extreme old age. The association of certain forms of insanity with advancing age is not one of effect and cause. Again, the fact that certain diseases of the mind tend to manifest themselves again and again with apparent recovery between the attacks, does not justify the assumption that a previous attack is the cause of a subsequent one. The Inspector-General records that in 132 cases the primary ætiological factor with unknown. From the information given, this number might be considerably larger.

The total number of persons who died during the year was 131 and of those who were discharged was 137. In regard to the deaths it is stated that 24 of the persons had suffered from senile dementia, 20 from secondary dementia, 12 from chronic mania, 11 from general paralysis of the insane, 10 from recent mania, nine each from chronic melancholia and systematized delusional insanity. Other forms of insanity appeared among these persons in smaller numbers. The actual causes of death appear to have been varied, although, as is usual both in the general population and among the insane, diseases of the cardio-vascular apparatus contributed the greatest proportion. The mental disease has lasted under a year in 35 of the patients, over one year and under five in 29 of the patients, over five and under 16 in 18 and over 15 in 24. The duration of the disease was unknown in 25.

It appears that a receiving house is about to be established at Enfield. The plans were drawn up after some of the officers of the Department had studied similar institutions in other States. It is hoped that when this department is opened, the overcrowding of Parkside will be relieved and that it will be possible to institute a proper classification of the patients.

Dr. Morris records with gratification the fact that the children inmates who were previously housed at Parkside, have been transferred to another institution. This is a great advance, as it is obviously an improper thing to associate imbeciles and children suffering from other forms of congenital defect with the insane.

It has been announced that Dr. Eugene Hirschfeld has been liberated from the Concentration Camp at Holdsworthy. It will be remembered that the Queensland Branch of the British Medical Association and several other bodies of citizens appealed to the authorities, when Dr. Hirschfeld was liberated on the first occasion, to re-intern him, with a view to his ultimate deportation. Steps are now being taken to induce the authorities to order the deportation.

It is with regret that we have to record the death of Dr. Nicholas Michael O'Donnell, of Victoria Street, North Melbourne.

At a meeting of the Tasmanian Branch of the British Medical Association held on January 14, 1920, it was resolved:

> That this Branch of the British Medical Association requests all Commonwealth, State and Municipal bodies who deal with medical appointments, to arrange that when new appointments are made, all things being equal, preference be given in the first place to returned medical officers and, secondly, to those rejected as medically unfit,

The undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

L. J. Hunter, Esq., M.B., 1915 (Univ. Sydney), Bellingen.
J. B. McElhone, Esq., M.B., Ch.M., 1919 (Univ. Sydney), Crick Street, Chatswood.
A. M. Langan, Esq., M.B., 1915 (Univ. Sydney), 10 Council Street, Waverley.
B. A. Veech, Esq., M.B., Ch.M., 1916 (Univ. Sydney), Canowindra.
W. W. Ingram, Esq., M.B., Ch.B., 1912; M.D., 1919 (Univ. Aberdeen), Huon Park, Turramurra.
G. A. Murray, Esq., M.B., 1919 (Univ. Sydney), Thursday Island.
Miss B. A. Mitchel, M.B., 1919 (Univ. Sydney), Mater Misericordiæ Hospital, North Sydney.
D. T. Rushton Smith, Esq., M.B., Ch.M., 1919 (Univ. Sydney), 68 Kareela Road, Cremorne.
W. S. Hawthorne, Esq., M.B., Ch.M., 1918 (Univ. Sydney), Liverpool Road, Summer Hill.
J. A. Lawson, Esq., M.B., Ch.M., 1918 (Univ. Sydney), "Clifton," Mary Street, Auburn.
J. W. Smith, Esq., M.B., Ch.M., 1916 (Univ. Sydney), "Tonbridge," 54 Walkers' Avenue, Haberfield.
M. J. Frizell, Esq., M.B., 1918 (Univ. Sydney), "Catfoss," Randwick.
E. B. Reed, Esq., M.B., Ch.M., 1919 (Univ. Sydney), Lewisham Hospital.
E. S. G. K. Vance, Esq., M.B., B.Ch., B.A.O., 1918 (Queen's University, Belfast), H.M.A.S. *Australia*, c/o. General Post Office, Sydney.

James Stewart, Esq., M.B., 1915 (Univ. Sydney), of "Catfoss," Randwick, has been nominated for election as a member of the New South Wales Branch.

Correspondence.

BRAIN WEIGHT IN CONGENITAL MENTAL DEFICIENCY.

Sir,—In the issue of January 10, 1920, Professor Berry says that I have erred in stating that recent work "has strengthened the popular idea that congenital mental deficiency is always associated with low brain weight."

Professor Berry says: "I have not once, but many times, stated, both in public and in print, that 'head measurements and the calculation therefrom of the cubic capacity of brain is not a measure of intelligence.'" Compare this with two statements made by him on May 2, 1917, at the Melbourne University before a meeting of the Victorian Branch of the British Medical Association, a report of which lecture appeared in *The Medical Journal of Australia* on June 23, 1917 (pages 537 and 540).

(1) "The facts appeared to point to an association between size of brain and mentality, and he (Professor Berry) knew of no evidence capable of scientific investigation which pointed to quality of brain rather than quantity as forming a dominant factor in the mentality of individuals."

(2) "It would be seen (from the diagram) that the cubic capacity of mentally deficient boys of the average age of 12 was approximately equal to that of State school boys of between 9 and 10."

These two statements made in 1917 undoubtedly strengthen the idea that congenital mental deficiency is always associated with low brain weight.

Professor Berry says: "Dr. Lind has weighed a few—altogether too few—(the number was 142) brains of congenital idiots . . . and has immediately jumped to the erroneous conclusion just quoted." Let me remind Professor Berry that in Diagram 5 he based his results on 14 State school boys and 39 mentally deficient children.

All people may not prefer to have the weights averaged and may like to see the actual figures for each case; and, further, to take the figures of the adults (as Professor Berry suggests) who comprise all clinical varieties of congenital mental deficiency with their various pathological changes, would defeat the object of the contribution, which was intended to show how varied the brain weights are in these cases.

The only other record of brain weights of any appreciable number of idiots which I could find was that quoted by Bastian and, as these weights were taken post mortem and not from ante mortem calculations, the methods of which vary from time to time, I can see no reason for questioning their accuracy solely because they were weighed in 1861.

Yours, etc.,

W. A. T. LIND.

18 Walpole Street, Kew,
January 15, 1920.

THE SIGNIFICANCE OF THE WASSERMANN TEST.

Sir,—Dr. Tidswell's exposure of the current misconception that "a positive Wassermann is always present in syphilis" is timely. He might have gone further and told us that the Wassermann is not specific. By a specific reaction we understand one between two bodies of the same species: thus the agglutination of typhoid bacilli by the blood serum of a typhoid patient is specific; so, too, was the original Bordet-Gengou reaction.

In the modern Wassermann test the reaction is between the body fluid of a patient and cholesterinized alcoholic extract of guinea-pig's heart; no syphilitic antigen is used. It is a valuable bio-chemical test for the presence in the body fluids of lipoids and these are admittedly more common in syphilis than in other diseases; but it is not a specific test. It compares with the diazo reaction, which is most common in typhoid, but occurs also in some cases of measles and of phthisis.

Both Wassermann and diazo are valuable; neither is specific.

Yours, etc.,

F. GUY GRIFFITHS.

171 Macquarie Street, Sydney,
January 16, 1920.

Proceedings of the Australian Medical Boards.

NEW SOUTH WALES.

The undermentioned have been registered, under the provisions of the *Medical Act, 1912 and 1915*, as duly qualified medical practitioners:—

Arthur Herbert Crowley, M.B., Bac. Surg., 1916 (Univ. Melbourne), Sydney Hospital.
Walter Leopold Calov, M.B., Mast. Surg., 1918 (Univ. Sydney), Moree.
William Wilson Ingram, M.B., Ch.B., 1912, M.D., 1919 (Univ. Aberdeen), Turramurra.
Eric William Beresford Woods, M.B., Bac. Surg., 1916 (Univ. Melbourne), Albury.
James Brown Sim, M.B., Bac. Surg., 1908 (Univ. Glasg.), Windsor.
Harold Walter Broadbent, M.B., Bac. Surg., 1919 (Univ. Adelaide), Sydney Hospital.
Leslie Thomas Allsop, M.B., Mast. Surg., 1916 (Univ. Sydney).

The following additional registrations have been made:—

Alan Thomas Roberts, F.R.C.S., Edin., 1919.
Wesley John Jenner, F.R.C.S., Edin., 1916.
Charles Badham, Mast. Surg., 1919 (Univ. Sydney).
Brenda Aileen Mitchell, Mast. Surg., 1919 (Univ. Sydney).
Clive Wentworth Thompson, Mast. Surg., 1919 (Univ. Sydney).
Cecil Uren, Mast. Surg., 1919 (Univ. Sydney).
Lennox Graham Teece, M.D., 1919 (Univ. Sydney).

VICTORIA.

The undermentioned have been registered, under the provisions of Part 1 of the *Medical Act, 1915*, as duly qualified medical practitioners:—

Edward Augustus Lermitte, M.B. *et* B.S., Durban, 1894; M.R.C.S., Eng., L.R.C.P., Lond., 1895, Mackenzie Street, Bendigo.
Emmanuel Rosanove, M.B. *et* Ch.B., Melb., 1919, 16 A.G.H., McLeod.

Norman Moir Simpson, M.B. *et* Ch.B., Melb., 1919, Cape Street, Heidelberg.
Jane McCully Fraser, M.B., Ch.B., B.A.O., R.U., Irel., 1907, Lauriston, *vid* Kyneton.
Adam Henry Muir Macmorran, M.B., *et* Ch.M., 1892, M.D., 1894, Edin., "Umina," Spring Road, Malvern.
Philip Francis Vincent Walsh, M.B. *et* Ch.B., Edin., 1917, Williamstown.

The following additional qualifications have been registered:—

Joseph Ivan Connor, Ch.M., Melb., 1917, D.T.M. *et* Hyg., Camb., 1919.
Judah Leon Jona, M.S., Adelaide, 1919.

The name of the late Dr. Thomas Thompson Dick has been removed from the Register.

Medical Appointments.

The appointment is announced of Dr. James Dawson (B.M.A.) as Government Medical Officer at Mittagong, New South Wales.

The Board of Public Health of Victoria has approved of the appointment of Dr. J. G. R. Felstead (B.M.A.) as Officer of Health for the Shire of Wimmera, Victoria.

Dr. Albert Curtis (B.M.A.) has been appointed Acting Medical Superintendent of the Hospital for the Insane and the Receiving House, Ballarat, Victoria, during the absence on leave of Dr. A. J. W. Philpott (B.M.A.).

Dr. W. H. Nelson (B.M.A.) has been appointed Acting District Medical Officer and Public Vaccinator, Perth, during the absence on leave of Dr. D. F. Blanchard.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser," page xxi.

Department of Public Health, Queensland: Microbiologist and Pathologist.

Government of Tasmania, Hydro-Electric Department: Medical Officer.

Australian Board of Missions, Sydney: Medical Officer.

Caboolture, Queensland: Medical Officer.

Medical Appointments.

IMPORTANT NOTICE.

Medical practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429 Strand, London, W.C.

Branch.	APPOINTMENTS.
VICTORIA. (Hon. Sec., Medical Society Hall, East Melbourne.)	All Friendly Society Lodges (other than the Grand United Order of Oddfellows and the Melbourne Tramways Mutual Benefit Society), Institutes, Medical Dispensaries and other Contract Practice. Australian Prudential Association Proprietary, Limited. Mutual National Provident Club. National Provident Association.
QUEENSLAND. (Hon. Sec., B.M.A. Building, Adelaide Street, Brisbane.)	Australian Natives' Association. Brisbane United Friendly Society Institute. Cloncurry Hospital. Chillagoe Hospital.
SOUTH AUSTRALIA. (Hon. Sec., 3 North Terrace, Adelaide.)	Contract Practice Appointments at Renmark. Contract Practice Appointments in South Australia.
WESTERN AUSTRALIA. (Hon. Sec., 6 Bank of New South Wales Chambers, St. George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW SOUTH WALES. (Hon. Sec., 30-34 Elizabeth Street, Sydney.)	Australian Natives' Association. Balmain United Friendly Societies' Dispensary. Canterbury United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Friendly Society Lodges at Lithgow. Friendly Society Lodges at Parramatta, Auburn and Lidcombe. Leichhardt and Petersham Dispensary. Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney. Marrickville United Friendly Societies' Dispensary. Newcastle Collieries—Killingworth, Seaham Nos. 1 and 2, West Wallsend. North Sydney United Friendly Societies. People's Prudential Benefit Society. Phœnix Mutual Provident Society..
NEW ZEALAND: WELLINGTON DIVISION. (Hon. Sec., Wellington.)	Friendly Society Lodges, Wellington, New Zealand.

Diary for the Month.

Jan. 28.—Vic. Branch, B.M.A., Council.
Jan. 28.—Northern District Med. Assoc. (N.S.W.), Annual General Meeting, Glen Innes.
Jan. 29.—S. Aust, Branch, B.M.A..
Jan. 29.—Central Western Med. Assoc. (N.S.W.), 8.30 p.m., at the Woolpack Hotel, Parramatta.
Feb. 4.—Federal Committee of the B.M.A. in Australia (Sydney).
Feb. 4.—Vic. Branch, B.M.A.; presentation of Balance Sheet for 1919.
Feb. 6.—Q. Branch, B.M.A..
Feb. 11.—Tas. Branch, B.M.A., Annual Meeting.
Feb. 12.—Vic. Branch, B.M.A., Council.
Feb. 12.—Q. Branch, B.M.A., Council.

EDITORIAL NOTICES.

Manuscripts forwarded to the office of this journal cannot under any circumstances be returned.

Original articles forwarded for publication are understood to be offered to *The Medical Journal of Australia* alone, unless the contrary be stated.

All communications should be addressed to "The Editor," *The Medical Journal of Australia*, B.M.A. Building, 30-34 Elizabeth Street, Sydney. (Telephone: City 2645.)